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OCT. 26, 1953

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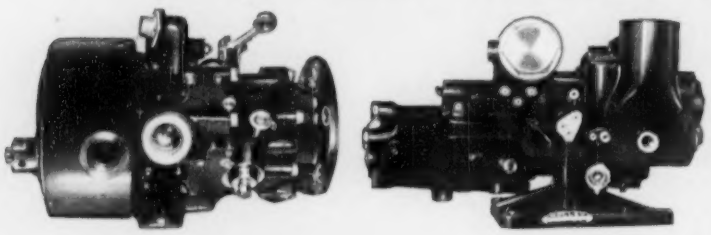

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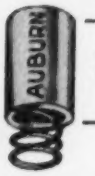

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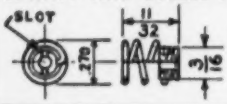

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Aviation Week

Volume 59 — October 26, 1953 — Number 17

Editorial Offices: 330 W. 42nd St., New York 36. Tel. Longacre 4-3000
National Press Bldg., Washington 4, D. C. Tel. National 8-3414

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AVIATION WEEK • October 26, 1953 • Vol. 59—No. 17
Member ABP and ABC

Published weekly by McGraw-Hill Publishing Company, James H. McGraw (1860-1948), Founder. **Publication Office: 99-129 North Broadway, Albany 1, N. Y.**
Executive, Editorial and Advertising Offices: McGraw-Hill Building, 330 W. 42nd St., New York 36, N. Y. Donald C. McGraw, President; Willard Chevalier, Executive Vice-President; Joseph A. Gerardi, Vice-President and Treasurer; John J. Cooke, Secretary; Paul Montgomery, Senior Vice-President, Publications Division; Ralph B. Smith, Vice-President and Editorial Director; Nelson Bond, Vice-President and Director of Advertising; J. E. Blackburn, Jr., Vice-President and Director of Circulation.
Subscriptions: Address correspondence to AVIATION WEEK—Subscription Service, 99-129 North Broadway, Albany 1, N. Y., or 330 W. 42nd St., New York 36, N. Y. Allow 10 days for change of address.
Subscriptions are solicited only from persons having a commercial or professional interest in aviation. Position and company connection must be indicated on subscription orders.
Single copies 50¢. Subscription rates—United States and possessions, $6 a year; $9 for two years; $12 for three years. Canada $8 a year; $12 for two years; $16 for three years, payable in Canadian currency at par; other Western Hemisphere, $10 a year; $16 for two years; $20 for three years. All other countries $20 a year; $30 for two years; $40 for three years. Entered as second-class matter, July 16, 1947, at the Post Office at Albany, N. Y., under Act of Mar. 3, 1879. Printed in U. S. A.

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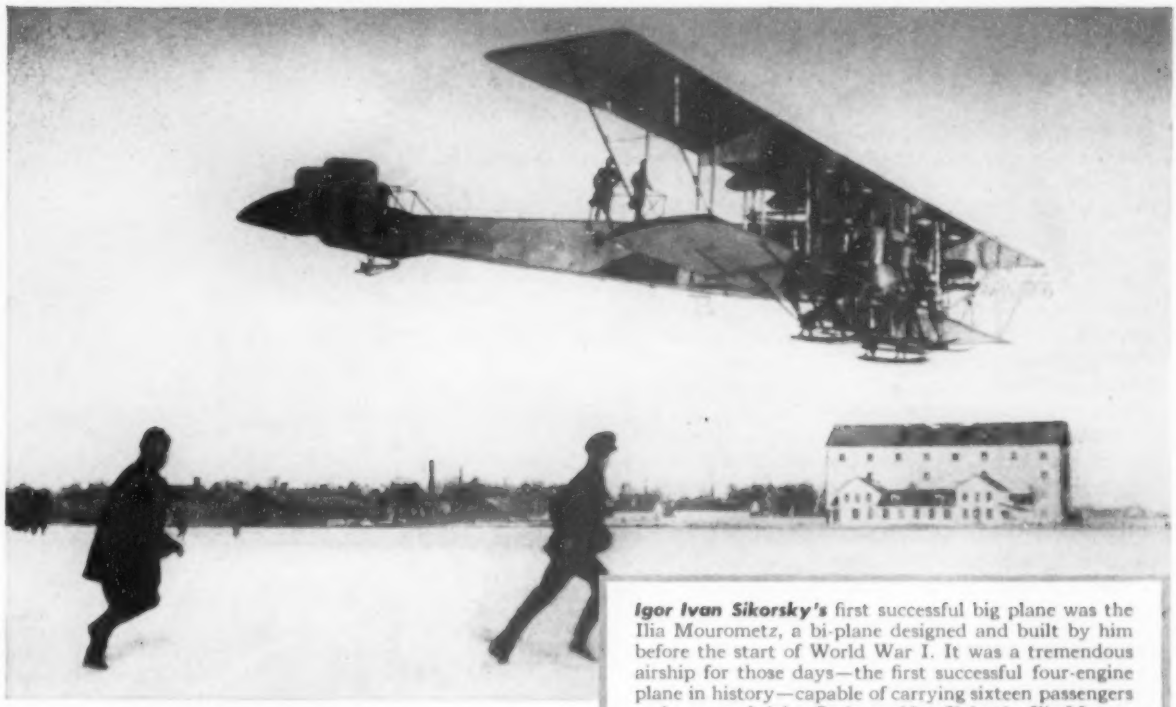
Sikorsky's First Big Plane—1914



Igor Ivan Sikorsky's first successful big plane was the Ilia Mourometz, a bi-plane designed and built by him before the start of World War I. It was a tremendous airship for those days—the first successful four-engine plane in history—capable of carrying sixteen passengers and a crew of eight. On its maiden flight the Ilia Mourometz flew for over 1½ hours without mishap. Photo above shows the big plane at a demonstration in 1914.

TODAY Igor Sikorsky is still a prominent figure in aeronautics. Having chosen to live in the United States, where the full measure of his genius can be realized, he has made valuable contributions to the progress of American aviation. As Engineering Manager of Sikorsky Aircraft—a Division of United Aircraft Corporation—he perfected the first successful helicopter in the Western Hemisphere. The famous aeronaut is shown above giving final inspection to one of the new Trans-Atlantic H-19 helicopters prior to its flight to Germany in late July 1952.

● Over the years the demand for better, more dependable aircraft has been met by the aviation industry with remarkable results. The improvement in aviation fuels has been one of the big factors contributing to the industry's progress.

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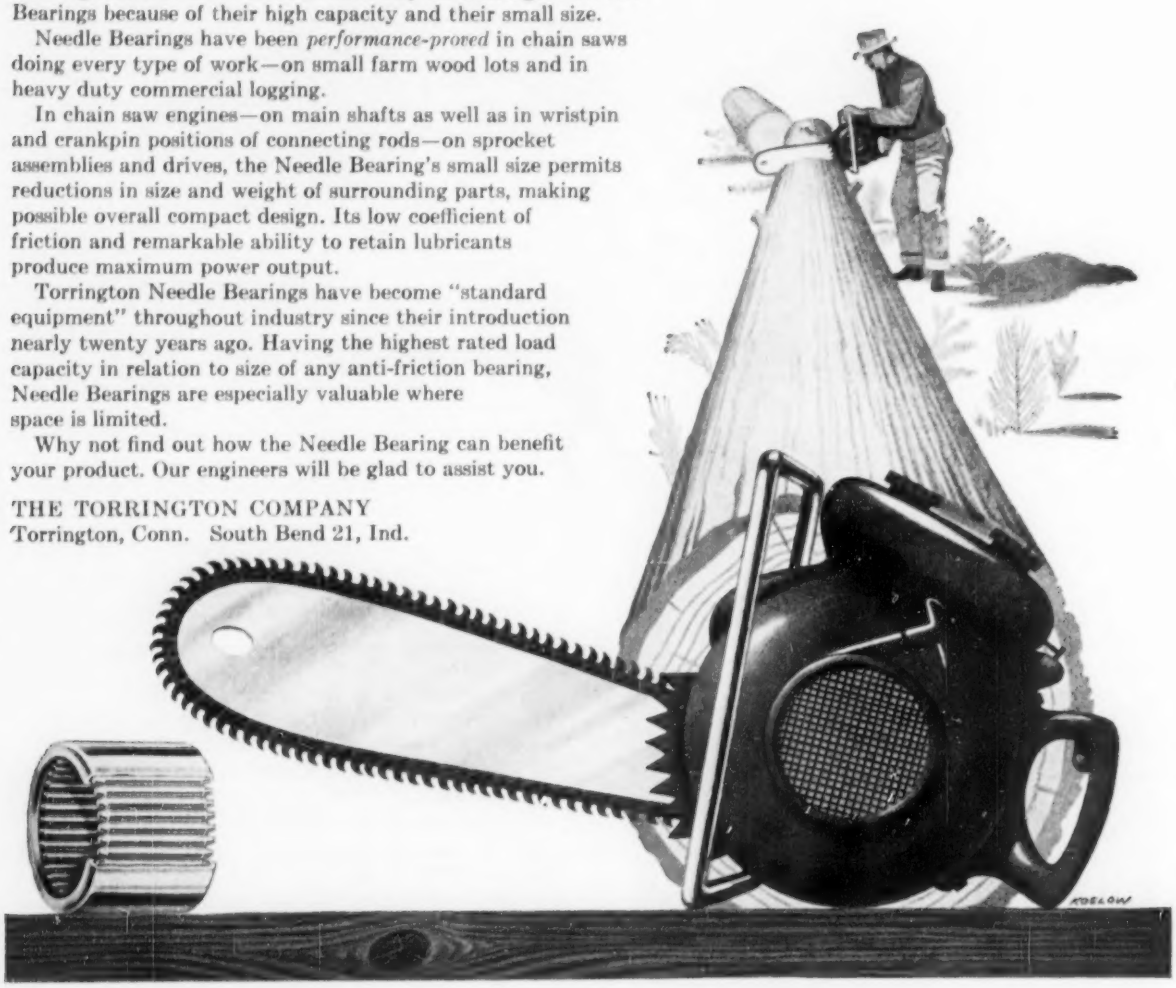

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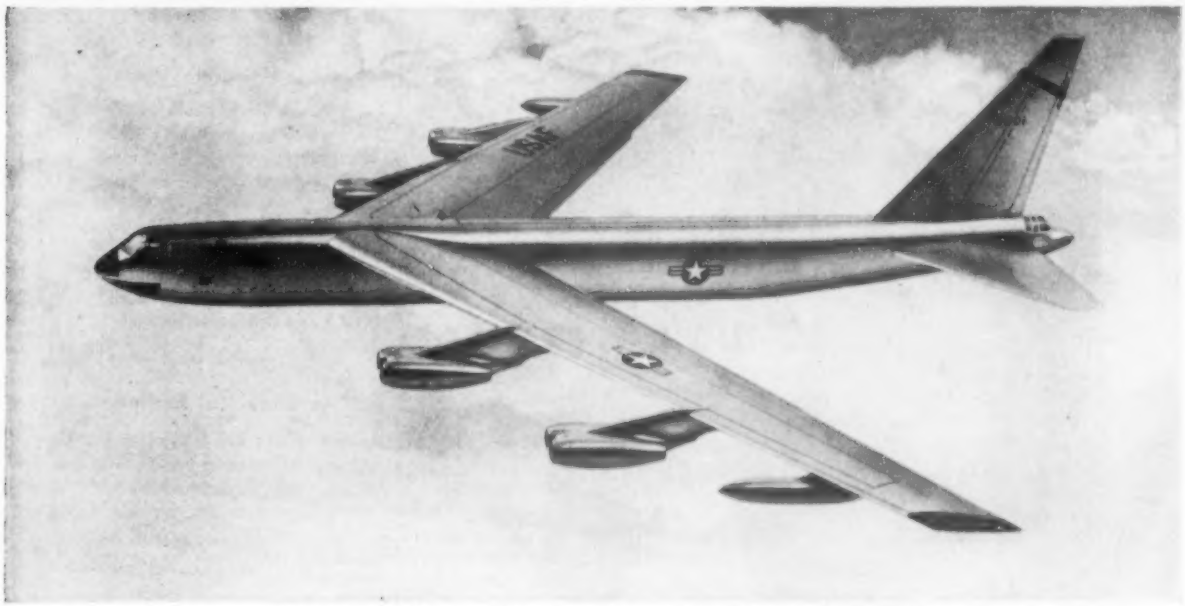

First Look at Production Version of B-52

Display model of the production version of Boeing's B-52 Stratofortress, set against a cloud background, reveals the new nose and crew cabin arrangement with side-by-side seating for pilot and co-pilot in place of tandem seats used in the XB-52 and YB-52 prototypes. Model of the production Stratofort, designated B-52A, also is fitted with auxiliary fuel tanks under the wings outboard of the engines. A sizable quantity of Stratoforts, enough to equip "more than seven" combat wings, has been ordered by USAF for its Strategic Air Command. Production of the heavy bombers is scheduled at Boeing's Seattle and Wichita plants.

Domestic

Eastern Air Lines Constellation crashed and burned when an engine caught fire seconds after takeoff from New York's Idlewild International Airport last week. Two of the 27 passengers aboard were killed and four were injured critically, ending EAL's safety record of more than 6.7 billion passenger-miles flown without fatality.

J47 jet engines produced by General Electric Co. have logged more than a million flight hours since 1948 in F-86s, FJ-2s, B-47s, B-36s and B-45s, GE's Aircraft Gas Turbine Division reports.

General Dynamics, Inc., says no deal is in the making for it or wholly owned subsidiary, Canadair, Ltd., to purchase an interest in Doman Helicopters, Inc. Doman has been carrying on independent negotiations with Fleet Mfg. Ltd., Ft. Erie, Ont., a Canadair subcontractor, as a possible purchaser of Doman stock and to obtain production facilities for the latter's LZ-5 commercial copter transport.

Military contract cutbacks will force Curtiss-Wright Corp. to lay off 700 production workers within the next few weeks at its Wright Aeronautical Division plant in Wood-Ridge, N. J., company officials announced last week. Spokesmen said approximately 19,500 workers still will be employed at the Wood-Ridge factory.

U. S. Air Force last week turned over to the Royal Canadian Navy operation of an Arctic radio station set up on Padloping Island during World War II to provide weather information and navigational aids to aircraft flying the northern route between North America and Europe.

Navy is sponsoring construction of a new $10.5-million factory by the Tube Reducing Corp. for production of aircraft tubing used in large propeller cores, landing gear struts, helicopter spars, rockets and Rato units. The 96,000-sq. ft. plant will be located at Wallington, N. J., is scheduled for completion early next year.

Air Transport Assn.'s facilitation committee last week held a closed-door session in Los Angeles to discuss problems of working out a new agreement between air carriers and the immigration service covering procedure for flying aliens traveling in the U. S. with transit visas.

Financial

Mooney Aircraft made a "small but definite" profit from sales totaling $75,000 during July and August, the first two months of full production at the company's new Kerrville, Tex., plant.

Trans Caribbean Airways paid a dividend of five cents per share on Class A stock Oct. 15 to holders of record Sept. 14.

International

Mexico-owned DC-3 crashed into the side of a canyon 15 mi. from Monterrey last week while carrying some of the nation's top reporters and entertainers to U. S.-Mexican ceremonies opening the Rio Grande's Falcon Dam. More than 20 persons were believed killed.

Fokker Industria Aeronautica, Rio de Janeiro, has signed an initial contract with Brazil's Ministry of Aeronautics to produce 100 Fokker S. 11 Instructors, 50 tricycle S. 12s and 50 S. 14 military jet trainers.

Air Chief Marshal Sir Robert Brooke-Popham, pioneer military aviator and first RAF officer to be appointed a commander in chief, died last week in Halton, England. He was 75.

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The Aviation Week

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Washington Roundup

Army Aviation Cut

Army aviation is feeling the economy knife. The Truman budget contemplated $151 million for procurement of Army planes, mostly large helicopters, this fiscal year. Now it is down to $140 million, and another big cutback is in prospect. Of the $140 million, only $89 million has been approved for obligation.

The outlook: The $51 million that has been frozen on a temporary basis will be frozen permanently. This would mean a total cutback of about 40% in Army aviation's procurement program for fiscal 1954.

Quarles Policies

Amid some apprehension that Defense Department's new tier of nine Assistant Secretaries would simply mean more interference in service activities, Donald Quarles, First Assistant Secretary for Research and Development, reports these policies will govern his administration:

• **Keep research and development activities** decentralized "down in the services" as much as possible. He will limit his office to guidance, review and coordination—except when a program gets "out of bounds" and there is need for topside decision.

• **Technical standing committees** patterned after the old R&D Board will be continued. But the trend will be to hold these down.

• **Increased emphasis on tapping private industry** and science. Consultant panels, working with the standing committees but reporting to the Secretary of Defense through Quarles, will be set up. The trend will be toward outside contracting for research and development. Quarles hopes to bring top experts into his office to serve as alter egos.

• **Improve "selectivity" of projects** through expert beforehand advice. But Quarles warns against the perfectionist hope that all projects will "pan out," stressing that in research and development it can be expected to improve only the percentage that do work.

• **Rush projects with a direct bearing** on continental defense. Russia's explosion of the hydrogen bomb resulted in this alteration in emphasis.

Cooper Subcommittee

One concrete development indicates that Sen. John Bricker will kill off the Cooper Aviation Subcommittee, as observers here have anticipated: Frank Keenan, its staff director, was dismissed by the senator, who took over the chairmanship of the full Senate Commerce Committee on the death of Sen. Charles Tobey. Bricker's office said Keenan had "resigned."

Tobey set up the subcommittee, headed by Sen. John Sherman Cooper, to make a thorough study of air transportation policy. Keenan was assigned to the group instead of Edward Sweeney, who until then had handled aviation matters for the committee. At the time, there was speculation that the subcommittee would be a sounding board for nonskeds.

Sen. Ed Johnson, who hired Sweeney during his regime as chairman, issued a blast against the nonskeds and warned that he hoped the subcommittee "will not be used unwittingly as a vehicle to promote selfish interests (of nonskeds) rather than the public interest."

Bricker's move, plus disinterest of Sen. Joseph McCarthy in launching an investigation of the scheduled airlines by his Senate Permanent Investigating Committee, seems to mean that the nonskeds will have to continue to rely on the Small Business Committee and individual members for congressional support in their fight.

One More Study

One more aviation study has been added to the many the Eisenhower Administration is making:

Commerce Department's new "Business and Defense Services Administration" has set up a "Shipbuilding, Railroad, Ordnance, and Aircraft Division" to watch over the health and vitality of the aircraft manufacturing industry. There is an "Electronics Division" to do the same for that industry, too.

The new administration's boss is Charles F. Honeywell, California business executive. After the pattern of the Office of Defense Mobilization, its 25 industry divisions are to have industry men serving brief periods of about six months as directors, and government career men as deputy directors to give continuity. Directors for the Aircraft and Electronics Divisions are now being selected. Launching the new administration, Commerce Secretary Sinclair Weeks described its activities:

"It is primarily an agency designed to serve business, to promote the expansion of employment opportunities, and in many ways to stimulate economic growth and stability. . . .

"It will be a listening post and sounding board for bringing business information and business opinion on vital matters relating to government and industry, including reports on business conditions, to the direct attention of the Commerce Department for appropriate action. . . ."

Renegotiation Law

Expiration of the Renegotiation Law Dec. 31 actually seems to mean little or nothing:

• **The Renegotiation Board** isn't being disbanded. Even if the expiration sticks, it has enough work on renegotiations of contracts up to the Dec. 31 date to keep it going for two or three years.

• **When Congress comes back** in January it is virtually certain the law will be extended and made retroactive. An extension measure passed the House and was approved by the Senate Finance Committee this year, but missed Senate passage in the session's windup jam.

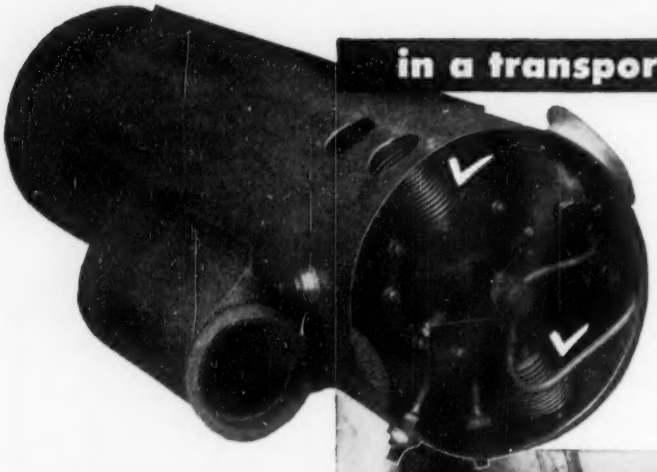
The board has been without a chairman since February. Members are: Charles F. Mills, former vice president of the First Boston National Bank; Frank Roberts, Detroit investment executive; Lawrence Harding, who has been in government renegotiation since 1942, and John H. Joss, former counsel for Firestone Tire and Rubber Co.

Air National Guard

Air National Guard reequipment program is scheduled to provide about 67% strength of first-line aircraft such as F-86, F-84 and F-94 by the middle of 1955. Rest of the ANG will use obsolete jets and second-line transport aircraft.

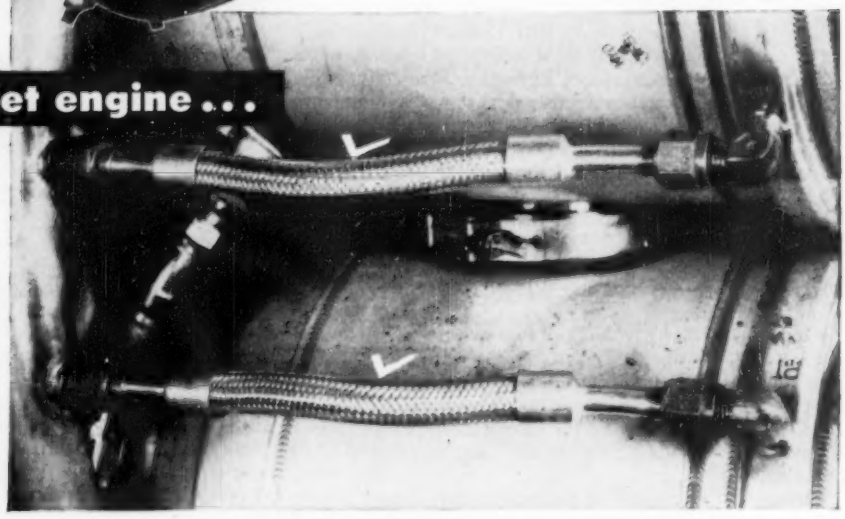
—Katherine Johnsen

in a transport heater . . .



300,000 B.T.U. heater manufactured by Surface Combustion Corp. for Douglas DC-6A, DC-6B and DC-7 models. The Rex-Flex units house the spark plug assembly and serve to eliminate vibration and correct for misalignment.

or a fighter's jet engine . . .



⅜" I.D. Rex Flex hose is used in the water injection system of this General Electric Co. J-47 jet engine manufactured by the Studebaker Corporation. It absorbs axial and lateral motion and vibration at pressures to 600 psi and temperatures to 500° F.

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WHO'S WHERE

In the Front Office

D. W. Rentzel, onetime chairman of Civil Aeronautics Board, has been elected a director of Central Airlines. Other new board members: **E. Stanley Klein,** president of John P. Maquire & Co., New York; **F. E. Howe,** Central vice president and treasurer; **William W. McGhee,** former cargo chief of the airline.

T. H. McLain has taken an extended leave of absence from Lockheed Aircraft Corp. to act as president of the Aircraft Chapter of Engineers and Architects Assn., Burbank, Calif.

Bert Goss is new executive vice president of Hill & Knowlton, Inc., New York.

H. Don Reynolds is resigning as attorney for Pan American World Airways to join Northwest Orient Airlines Nov. 15 as executive assistant to the president.

Alexander G. Hardy has been elected assistant vice president of National Airlines.

Col. R. W. Knight, former USAF deputy director of flight safety research, has been appointed assistant to the president of Resort Airlines.

Changes

Earl B. Smith will become director of transportation and communication under the Assistant Secretary of Defense for Supply and Logistics Nov. 1, succeeding **Kenneth L. Vore,** who has resigned to return to private industry.

Brig. Gen. Peter C. Sandretto (USAF Reserve) is new technical director of the Federal Telecommunication Laboratories, Nutley, N. J.

K. J. G. Bartlett has resigned as sales director Bristol Aeroplane Co., Bristol, England, but will remain on the company's board.

A. O. Willis has been promoted to assistant general manager Curtiss-Wright Corp.'s Metals Processing Division, Buffalo, N. Y.

Robert A. Wagner has been appointed chief engineer of Hiller Helicopters, Palo Alto, Calif.

Al Hill has been promoted to assistant director of public relations and advertising for Boeing Airplane Co., Seattle. **Jack Mitchell** succeeds Hill as public relations manager Boeing-Wichita.

Honors and Elections

Duke of Edinburgh has accepted an honorary fellowship from the Royal Aeronautical Society. Also made honorary fellows: **Sir Geoffrey de Havilland, Sir Arthur Gouge** and **Lord Hives.**

Wilbur W. Brown, electronics engineer at General Electric, has received the Exceptional Service Award from the Military Air Transport Service for helping establish "vital radio circuits in the installation of radio facilities."

Fred L. Plummer, director of engineering at Hammond Iron Works, Warren, Pa., has been re-elected president of the American Welding Society.

INDUSTRY OBSERVER

► Republic Aviation will mate a General Electric J73 turbojet to its F-84F Thunderstreak airframe for experiments to determine the suitability of the GE powerplant as a replacement for the Wright J65 now used in the swept-wing fighter. The J73-powered F-84F is scheduled to fly early next year. Final decision on switching to the J73 will not be made until after flight tests of the experimental installation.

► Northrop is at work on a delta-wing all-weather fighter designed to succeed the Scorpion. The new engineering group at Northrop hopes that this design, together with their Fang lightweight fighter proposal, will put the company back into the USAF fighter picture. Insiders at Northrop say the company has decided to concentrate on aircraft for the immediate future rather than guided missiles, although Northrop's Snark SB-62 generally is conceded by USAF experts to be the best of the current surface-to-surface missile types now flying.

► Lockheed is modifying an F-94B all-weather fighter to accommodate the business end of the Boeing Bomarc missile. The F-94 and F-99 combination will be used as a flying test bed for development of air defense missile systems.

► North American is building a two-place version of the F-86 Sabre. It is expected to fly before the end of the year.

► USAF finally has confirmed officially the maximum performance figures for the Bell X-1, first piloted aircraft to fly faster than sound. The X-1 hit its top speed of 967 mph. in 1948, reached an altitude of 70,140 ft. in 1949.

► U. S. aircraft industry has produced about 15,000 jet aircraft to date. Of these, about 3,500 have been delivered to Navy, slightly less than 2,000 to foreign countries under MDAP. Aircraft Industries Assn. reported correctly that about 10,000 have been delivered to USAF.

► Long-range thinking for rooftop helicopter terminals in New York involves proposed installations on top of the Port Authority suburban bus terminal at 41st St., and on top of the East Side air terminal. Major drawback to such installations is the large cost, which could not be justified until high-density helicopter bus traffic becomes a reality.

► Napier's two engines—the compounded diesel Nomad NNM 6 and the gas turbine Eland—will be airborne for the first time towards the end of the year. Nomads will fly in the outboard nacelles of an Avro Shackelton, which may some day lead to a new lease on life for the Shackelton with RAF Coastal Command. The Eland will fly in a Vickers Varsity test bed. Neither engine is in production; Napier has no available floor space after setting up licensed production lines for the Rolls-Royce Avons.

► Glenn L. Martin Co. successfully has tested a recoverable drone system on its B-61 Matador.

► British study of troop carrying by air pointed up obvious superiority of jet transport for the job. Currently, 12 Handley Page Hastings (roughly equivalent to the Douglas DC-4) would require six weeks to transport about 1,500 troops over a 3,000-mi. distance. In contrast, two jet transports equivalent to the Vickers Valiant could do the job in 12 days.

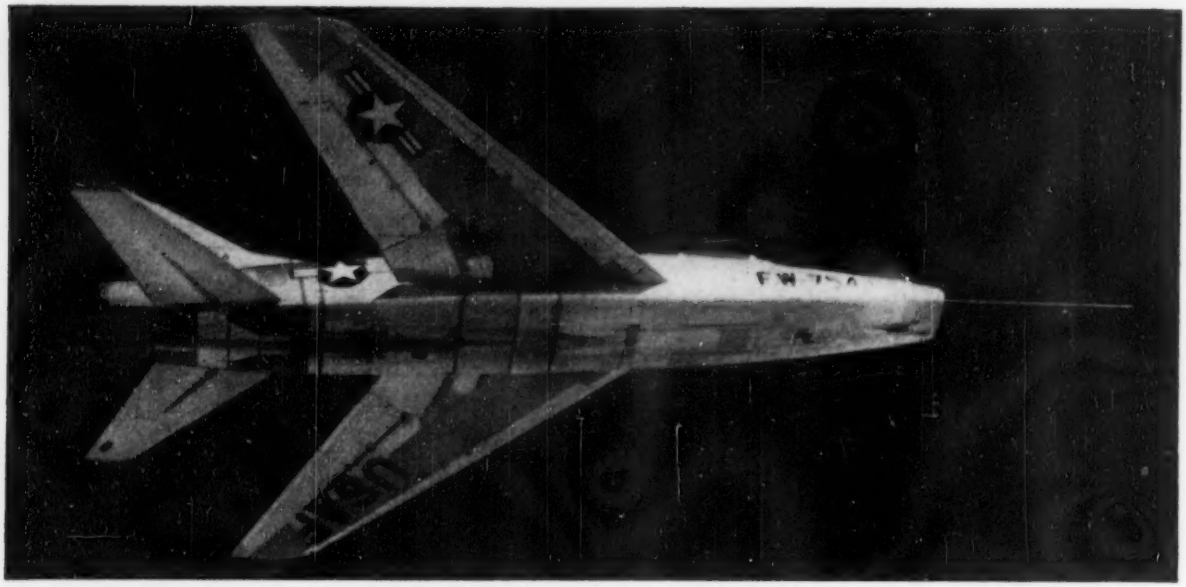
► Canada plans to outfit its new aircraft carrier Bonaventure (AVIATION WEEK June 1, p. 7) with McDonnell F2H-3 Banshees, has ordered 60 at a cost of more than $20 million. Bonaventure will not be ready until 1956, but Naval Airmen are expected to use the carrier Magnificent to start conversion to jets late next year. Banshee order will provide 25 planes on the carrier, 25 in reserve at Halifax Naval Base and 10 for training.

► Latest idea in helicopters: a copter tug. Plan would be to use copter to snag plane in flight, lower it to ground after plane's engines have been cut.

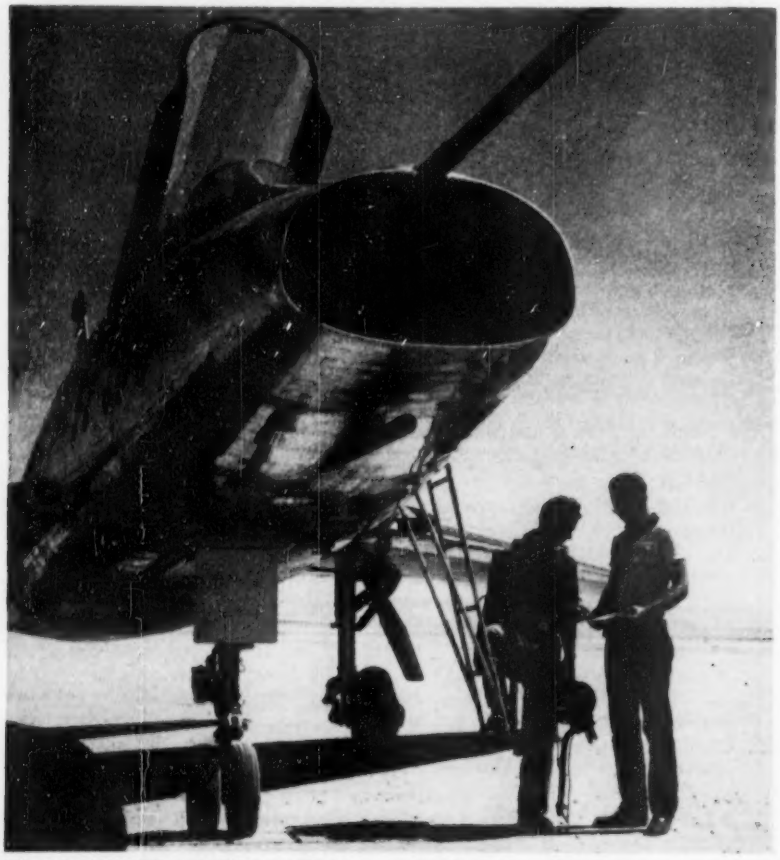
AVIATION WEEK

VOL. 59, NO. 17

OCTOBER 26, 1953



F-100 Passes Mach 1 in Transonic Dives



LARGE INTAKE for P&WA J57 juts over head of test pilot George Welch (left).

- **NAA takes wraps off Super Sabre jet fighter.**
- **Test pilot reports good response at low speeds.**

By William J. Coughlin

Palmdale, Calif.—North American Aviation unveiled its F-100 Super Sabre here last week in a demonstration of low-level supersonic flight that shattered plate glass windows and split four-by-four timbers in the USAF Administration Building.

Test pilot George Welch slammed the fighter low across the building in three supersonic dives that rocked onlookers with the shock of sonic booms.

▶**Mach 1 Dives**—The test pilot then made a slow flyby with wheels and saw-tooth dive flaps extended from the Super Sabre's bulging fuselage.

After kicking in the afterburner with a roar, he circled and landed noschigh at a speed estimated at between 130 and 150 mph.

Welch later told newsmen the F-100 traveled well over Mach 1 in dives from 15,000 ft.

"The airplane will go a lot faster than that," he said.

▶**Onlookers Gasp**—The first public demonstration of the new North American aircraft left onlookers gasping and children crying.

YF-100 IN FLIGHT with tricycle landing gear extended and large airbrake lowered beneath the jet fighter's belly aft of nose gear.

Among those gathered for the demonstration were NAA chairman J. H. (Dutch) Kindelberger; president J. Lee Atwood and Lt. Gen. Orval Cook, Deputy USAF Chief of Staff for Materiel.

► **Razor-Thin Wing**—Prior to the flight demonstration at Palmdale, newsmen were given a closeup look at the first production F-100 off North American's Inglewood assembly line.

The F-100 displayed a razor-thin, 45-deg. swept wing and tail. Ailerons were several feet inboard.

There were no elevators on the tail surface, which was entirely flyable. Contrary to the usual supersonic trend, the tail was placed low on the fuselage.

► **Highspeed Answer**—Commenting on the unusual control arrangement, test pilot Welch said: "I think we've got the answer in this airplane as far as highspeed flight is concerned.

"It flies at .3 Mach number just as well as over Mach 1."

► **50,000-Ft. Ceiling**—The Air Force allowed NAA to reveal that the supersonic fighter, powered by a Pratt & Whitney J57 engine, has a service ceiling above 50,000 ft. and a combat radius of more than 500 nautical mi.

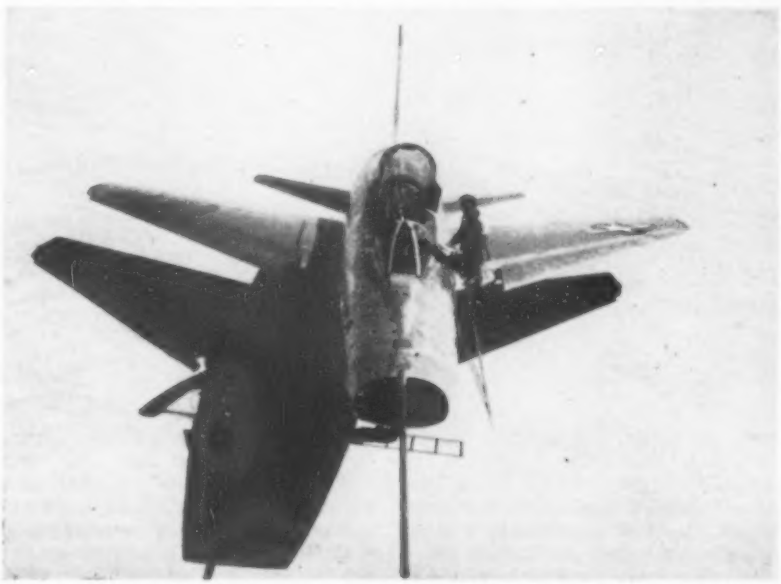
All of the F-100's fuel is carried in the fuselage.

The Super Sabre is 45 ft. long, 14 ft. high and has a wingspan of 36 ft.

Titanium is used extensively throughout the aircraft. The clam-shell canopy is ultra streamlined. The F-100 has automatic leading edge slats similar to those used on early models of the F-86.

The fighter has an automatic air-conditioning and pressurizing system. A drag chute is used to shorten landing rolls.

LONG, SLOPING NOSE of YF-100 is apparent in this three-quarter front view.



WIDE FUSELAGE, clamshell-type canopy and leading edge slats are visible here.

Airpower Bottleneck:

Titanium Shortage Blocks Buildup

Senate subcommittee calls for hundred-fold expansion of metal production for new military aircraft designs.

By Katherine Johnsen

Convinced that a titanium shortage is a major threat to the United States' airpower position, a Senate subcommittee is pushing for a radical hundred-fold expansion of productive capacity.

The Strategic Metals Subcommittee of the Interior and Insular Affairs Committee, headed by Sen. George Malone, was given this gloomy picture by Brig. Gen. Kern Metzger, chief of Air Materiel Command's Production Resources Division.

▶ **1,000 Tons Short**—Metzger called for "an immediate expansion" of titanium capacity "as fast as possible." He said:

• **The 1953 requirement** for titanium in the Air Force aircraft program is 3,500 tons. But total production, estimated at 2,450 tons, will be more than 1,000 tons short of this requirement.

• **USAF aircraft** requirement for the metal will shoot up sharply during the next few years, and the shortage will be even more acute.

• **The 1956 minimum** requirement for USAF's aircraft program will be 35,000 tons. But under contemplated expansion, output will be only 25,000 tons.

"I have stood against socialism," Malone declared. "But I am adamant that we spend whatever money is necessary on titanium pilot plants or take other necessary steps to assure our airpower position until private outfits can take over and go ahead on a commercial basis."

Other members of the subcommittee are Sens. Eugene Millikin, Frank Barrett, James Murray and Earle Clements.

▶ **Best Advantage**—The 35,000-ton requirement takes care only of USAF's minimum needs for aircraft, Metzger reported. In addition, Army and Navy have pressing requirements for the metal. For example, Army wants to use it in tank production.

"But Army and Navy have taken the position," the general said, "that due to the very limited supply, it was to the best advantage of the country to withhold their use of the metal in favor of the military aircraft program."

The three services easily could utilize to great advantage more than 100,000 tons of titanium annually, he said. In view of this, plus wide commercial use for the metal, Malone suggested the U. S. should shoot for 200,000 tons a year capacity, or about a hundred times current output.

▶ **Importance to Airpower**—Metzger stressed these points in emphasizing the importance of titanium to airpower:

• **It can be produced** without off-shore support. Although current production in the U. S. is from Australian-imported rutile, approximately a third of the states have extensive deposits of ilmenite from which titanium also may be manufactured. And particularly large deposits are in Florida, Georgia and California.

• **Faster, higher-flying** aircraft that are the key to future air superiority require titanium, twice as strong and far lighter than aluminum for skin surfaces and in engines. Use of titanium in powerplants of a four-engine military plane, Metzger said, saves 2,000 lb. of weight.

• **Extensive deposits** of titanium are known to exist in the U.S.S.R.—and in Canada, India, Australia, Norway, Ceylon, Brazil and Sweden.

Failure of the U. S. to utilize the metal in its military aircraft could mean that Russian planes would be superior in performance, the general said.

▶ **Design Bottleneck**—The Air Force already is holding back approval of use of titanium in aircraft designs because of the shortage, he told the Senate subcommittee.

"But still of greater importance, I believe, and of more serious nature, the aircraft designer himself is holding

USAF PILOTS FLIGHT TEST CAPTIVE MIG

Fairly exhaustive tests of the captive MiG-15 on Okinawa have produced an official Air Force verdict that the Russian-built fighter generally is inferior to its U. S. counterpart, the North American F-86 Sabre. Gen. O. P. Weyland, Far East Air Forces commander, reports that flight tests made by Maj. Gen. Albert Boyd, commander of Wright Air Development Center, Dayton, Ohio, and Maj. Charles Yeager, first supersonic pilot, revealed the MiG had lower maximum speed than the Sabre and lacked automatic equipment and controls common to U. S. fighters. Boyd and Yeager reported that lack of such equipment kept them so busy that their attention was diverted from alert flying. Insufficient stall warning was noted, along with a poor heating and ventilating system. The cockpit is too small for Americans, the pilots reported. As yet there is no sign of Russia or North Korea demanding the MiG's return, although the U. S. has offered to turn it over to the rightful owner. Note USAF markings.

back," Metzger said. "Our own manufacturers, due to their inability to secure the material, are now postponing the date at which they incorporate the material in some design changes. . . .

"We know at this point that there are aircraft fairly well along in design that we need, and the country needs, to achieve air superiority, and which must use titanium in substantial quantities."

► **Limited Production**—There now are three titanium producers in the U. S.: Titanium Metals Corp., du Pont de Nemours Corp., and Crane Co. Through loans to be repaid by production, the government has spurred their expansion, but it falls far short of meeting requirements:

• **Despite a Defense Department** request that titanium capacity be expanded to 35,000 tons a year by 1956 to meet only the minimum military aircraft requirement, the Office of Defense Mobilization has authorized an expansion goal of only 25,000 tons a year by 1956.

• **Of the authorized expansion,** capacity for only 13,400 tons a year by 1956 has been contracted. This is divided: Titanium Metals, 3,600 tons; du Pont, 3,600 tons; and Crane, 6,000 tons.

In addition, output at a facility of the Bureau of Mines at Boulder City, Nev., will reach 200 tons a year. U. S. imports about 10 tons a month from Japan.

► **Commercial Study**—Despite its high cost of $15 a pound, titanium would be profitable for use in commercial airliners if it were available because of the increased payload that would be possible, Metzger said.

A study by Douglas Aircraft Co. showed that use of titanium in engine nacelles and certain other parts of the DC-7 would reduce the weight by 300 lb., he added, "or allow for 1.5 more passengers for the entire life of the plane—and would be a bargain. Through use of titanium, a 60-passenger plane could become an 80-passenger plane."

Air Force, Navy Pare Letters of Intent

Both Air Force and Navy are making strenuous efforts to eliminate the huge backlog of letter-of-intent contracts, most of them for aircraft, resulting from the Korean crisis of three years ago.

USAF says it expects to reduce its letter contracts to the vanishing point by the end of 1953. This backlog has been shrinking steadily during the summer and early fall. Last June, USAF reported letter contracts valued at $3,586,000,000, with a reduction to $1,508,086,000 by Aug. 31 and to $1,178,908,000 by Sept. 30.

No Bidders

There were no bidders when Hughes Aircraft Co.'s $11.5-million guided missile plant was put up for auction sale by Pima County officials for delinquent taxes at Tucson, Ariz., Oct. 16.

The county claims Hughes owes $214,854.68 in back taxes for 1952. A company spokesman contends that the plant was sold to the Air Force in December 1951. Mixup arose, he says, when the Corps of Engineers failed to file the deed for USAF in Pima County.

It may require conferences between federal and county officials to straighten out the legal complications.

► **Navy Cuts**—Vice Admiral John Gingrich, new Chief of the Office of Naval Materiel, reports Navy cut its June 30 backlog of 711 letter contracts valued at $5,128,000,000 to 572 letters valued at $4,606,577,000 by Sept. 30.

Air Force Secretary Harold E. Talbott, outlining AF policy, said:

"Letters of intent and letter contracts had their place in the emergency after the outbreak of the Korean war, but I see little reason for them now. The Air Force is interested in reducing the number of letter contracts as fast as possible. Some are being canceled and others are being converted to formal contracts as fast as possible.

"Requests for new letter contracts are being scrutinized with the greatest care. Most are being returned with the suggestion that every effort be made to write and sign formal contracts. Only in emergency cases should letter contracts be issued. Then it should definitely be understood that a formal contract will follow in the agreed 90 days."

► **B-47 Cuts**—USAF reports its more-than-$2-billion drop was due mainly to conversion of letters of intent for the Martin B-57A and the Douglas C-124C to firm contracts and cancelation of letter contracts for a portion of the B-47 production at Boeing-Wichita, Douglas-Tulsa and Lockheed-Marietta.

The B-47 accounted for a reduction of $600 million and is reported to be the highest-value letter contract ever written for a single aircraft type. The $53-million General Electric letter of intent on the J73 turbojet engine also was converted to a firm contract during this period.

Most of the 156 USAF letter contracts remaining on Sept. 30 are expected to be converted to firm contracts or canceled by Jan. 1, 1954. Most of the cancelations will involve aircraft engine types already announced as scheduled for reduction (AVIATION WEEK Sept. 28, p. 14).

Army only has 29 letter contracts valued at $116 million, reports all are being converted into firm contracts.

CPA DC-6B Flies Pacific Nonstop

Canadian Pacific Airlines has flown a DC-6B with 43 passengers and a crew of seven nonstop from Misawa, Japan, to Vancouver International Airport, B. C., marking the first time this feat has been accomplished by a commercial plane, says the carrier.

Taking advantage of favorable winds, the DC-6B's captain, T. A. Tweed, flew the Great Circle route via the Aleutians in 14 hr. 42 min., registering an average speed of 305 mph.

HERE IS TRI-PACER FOR 1954

First flight view of the 1954 Piper Tri-Pacer which features several interior improvements over previous models. Among them: foam rubber seat cushions and individual cool-air scoops in each side window. The VHF transmitting antenna, formerly mounted atop the wing, has been buried in the fin, eliminating considerable wind noise. Powerplant is the 135-hp. Lycoming, giving the lightplane a cruising speed of over 120 mph. The four-place Pacer with tailwheel landing gear is being produced at Lock Haven, Pa.

F-102 Features Thin Delta Wing

Convair prepares new fighter for first tests, expects all-weather jet to hit transonic speeds in level flight.

Edwards AFB, Calif.—With Convair's delta-wing F-102 scheduled for its initial flight test Wednesday, USAF last week revealed only scant details of its new supersonic all-weather fighter.

Announcement of the F-102's maiden flight was due soon after a demonstration for the press of another in the Air Force supersonic fighter series, the F-100 (see p. 12).

First flight of the F-102 originally was set for Oct. 19 but was postponed by the company. At least one of "several reasons" for the delay was known to be mechanical.

Chief project test pilot Dick Johnson was named to take the F-102 aloft on its initial test.

▶**Transonic Level Flight**—A brief announcement, cleared by USAF, said the fighter is capable of supersonic speeds in straight and level flight.

Like the F-100, it is powered by a Pratt & Whitney J57 but is designed to take a more powerful engine as soon as it becomes available.

Mach rating is higher than that of the transonic F-100.

USAF allowed Convair to mention "significant improvements" in avionics and armament but withheld further details. The F-102's fire control system is built by Hughes Aircraft Co., which also produces the Falcon air-to-air missile.

Convair said design and production of the YF-102 at San Diego set a new national record for speed of manufacture for a prototype of this size and complexity.

▶**Bulging Fuselage**—Similar to its XF-92 predecessor, the F-102 is larger than both the XF-92 and its water-based sister ship, the XF2Y Sea Dart.

Its wide delta wing is very thin, and an unusual intake arrangement on either side of the bulging fuselage gulps air for its J57 engine and afterburner.

Vertical stabilizer is smaller than customary for a delta-wing aircraft of its size.

Spear-nosed, its canopy arrangement resembles that of the YB-60. Radar equipment will replace the spear-nose instrumentation in the production model.

▶**High-Geared Schedule** – Convair crews from San Diego worked almost "around the clock" at Edwards to prepare the F-102 for its first flight after the fighter arrived at this desert test base Oct. 6.

"Special commendation is due to engineering and experimental people who performed so well under the pressure of this schedule," commented Frank Fink, chief engineer at the company's San Diego Division.

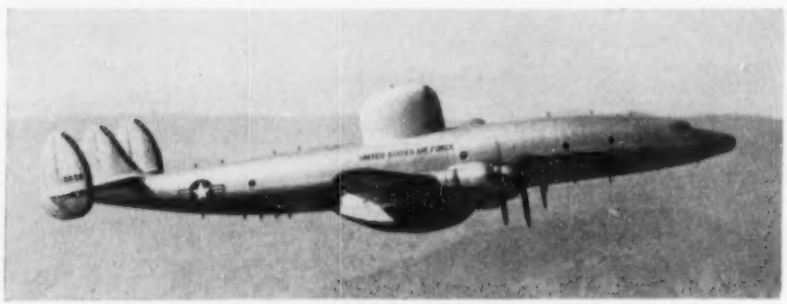
According to Convair, the time required to design and build the F-102 was 18 months from start to finish. Experimental shop completed manufacture in the unprecedented time of five months from the date of final engineering release, the company reported.

▶**Complex Prototype**—"The accomplishment of this engineering and experimental manufacturing program is even more impressive if it is realized that this is a 'production' airplane," said J. F. Schirtzinger, assistant San Diego chief engineer.

"Usually a prototype is made as simply as possible with as few parts as possible. Later on it is redesigned for higher production.

"In the case of the YF-102, however, the first airplane is substantially the same as subsequent airplanes. Thus, there probably were a third more parts and more than four times the tooling match points in the prototype than would normally have been expected."

Schirtzinger estimated that the elapsed time could have been reduced by three months if the YF-102 had been a conventional prototype. —WJC



USAF'S SUPER CONNIE 'WATCHDOG' ALOFT

Initial flight view of the new Lockheed RC-121C Super Constellation radar picket being produced for the USAF. The Wright Turbo Compound-powered pickets are designed to carry complex avionics devices to high altitudes, thus avoiding the normal line-of-sight limitation of ground-based radar which normally would permit sneak raiders to attack successfully. Similar Super Connies are also being built for the U. S. Navy. For detailed story on RC-121C see Aviation Week Aug. 24, p. 17.

Project Tinkertoy Is Hit of AES Show

Los Angeles—More than 100 displays were set up for the Aircraft Electrical Society's annual display meeting at the Pan Pacific Auditorium Oct. 15 and 16. It was the largest exhibit since inception of the society in 1941.

The AES, an organization devoted to promoting recognition of avionics, exhibited items of equipment from both large and small manufacturers.

Project Tinkertoy (AVIATION WEEK Sept. 28, p. 17), shown for the first time on the West Coast, was the big hit of the show.

A 27-min. movie of the automatic factory developed by Navy's Bureau of Aeronautics and the National Bureau of Standards was shown to about 2,300 persons. It ran continuously during the two-night meeting.

Items on exhibit, some for the first time, included:

• **A 20-watt transistor** with more than 100 times the power of present commercially available types. It was developed by the Minneapolis-Honeywell Regulator Co.

• **Light-weight induction generator** displayed for AiResearch Mfg. Co., suitable for aircraft and guided missile application. The complete unit weighs 16.36 lb. and puts out one volt-amperes.

• **Electro-Aire** showed a new 1-in.-diameter motor, designated A-711. This motor is an intermittent-duty series type for either high- or low-temperature operation. It meets MIL-I-6181 radio noise requirements by use of attached filter. The total weight of motor without noise filter is 3.1 oz. Output at 20,000 rpm. is 1.2 oz. in. with minimum stall of 3.5 oz. in. at 27 volts.

• **Pendar** displayed a three-week-old automatic dimming light used to cut instrument panel lights from 20 to 9 volts.

CRAF Increases

Defense Air Transportation Administration has increased the airlines' Civil Reserve Air Fleet requirement from 294 four-engine transports to 308.

The extra 23 planes are "to provide replacements for aircraft lost to CRAF through accidents, foreign sales, etc," DATA says.

Policy Study Stresses Civil Aviation

The Republican Administration's air policy review ordered by the President will concentrate on civil aviation development, use existing agency studies, and take written recommendations from industry groups rather than hold public hearings.

Commerce Undersecretary Robert Murray, whom the President charged to make the study as chairman of Air Coordinating Committee, revealed more details in a speech to surface carriers' National Defense Transportation Assn. in Louisville, Ky., as forecast in AVIATION WEEK (Oct. 5, p. 17).

Highlights of the program:

- **Military aviation policies** will come under review in "many important areas" where civil activity bears on military—such as mobilization, Military Air Transport Service, airways, airports, international airline routes.
- **Each ACC agency,** including CAA, CAB and military, will develop its comments and proposals, "consulting with other agencies to the extent necessary."
- **Industry groups** "will be invited to submit pertinent information and recommendations," but "limitations of time and personnel will preclude the holding of formal, public hearings."
- **Completion date** is slated for the end of March.
- **Legislative proposals** will be made where recommended policy revisions cannot be accomplished by simple administrative action.
- **Airline, airway and airport studies** already under way in Murray's offices will be utilized in the ACC review.

▶**Commerce Department Power**—Explaining Commerce Department powers in civil aviation, Murray said Commerce has studies already under way, for completion late this year, including "a review of policies for airline development . . . airport development, and the question of charging for the use of federal airways."

These studies though started earlier, are "basically the type of policy re-examination requested by the President" (AVIATION WEEK Oct. 5, p. 17). They are conducted to assist the Secretary of Commerce in discharging his responsibilities as the chief advisor to the President on transportation policy within the Executive Branch," Murray said.

▶**CAB Power**—He explained the relationship of Commerce and Civil Aeronautics Board powers as follows:

- **Airline subsidy.** "Authority over airline subsidy payments and related matters is vested in the Civil Aeronautics Board, an agency of Congress."
- **CAB changes.** "However, should it appear . . . that a sound total transportation policy requires adjustments in the field of aviation, it is the department's clear responsibility to recommend such changes. If these changes can be effected by the CAB under existing legislation, our recommendations would be submitted to that agency for its consideration. If revisions in basic legislation seem needed, our recommendations to that effect would be presented to the President for submission to the Congress. In this connection I am happy to say that I have the formal assurance (see box) of the CAB that we will receive its full cooperation in the conduct of our studies of air transportation," Murray concluded.

CAB Policy

Civil Aeronautics Board Chairman Oswald Ryan in the following letter pledges the Board's full cooperation in the Administration study of airline subsidy, airport aid and airways user charges now under way at the office of Commerce Undersecretary Robert Murray:

"Dear Mr. Murray:

This morning I reported to the full Board the substance of our conversations today relating to your study of civil air transportation. You will be interested to know that the Board unanimously requested me to advise you that you can count on the full cooperation of our entire organization, including all members of the Board and all members of our staff.

We greatly appreciate your cooperative attitude and are looking forward to working with you and to helping you in every way possible in completing your study.

Sincerely yours,
Oswald Ryan
Chairman"

Talbott Calls Red AF 'World's Largest'

Air Force Secretary Harold E. Talbott estimates that Russia's air force is composed of some 20,000 aircraft, "numerically the largest in the world."

Soviet air strength is made up of approximately 15,000 jet interceptors, more than 1,000 Tu-4s bombers (resembling USAF's B-29) and a "constantly increasing number of fast jet light bombers—her Il-28s—which may compare in performance to our Martin B-57 and the English Canberra," Talbott told the 14th annual automobile old timer dinner in New York.

He describes Russia as a self-sufficient nation, well isolated as a continental power.

"It is clear that our only means of striking a decisive blow on Russia, should she begin a war, lies through air power," the Secretary says.

It is Talbott's claim that "nothing in the world compares to our B-52 intercontinental bomber or our workhorse, the B-47, and certainly no fighter aircraft in production compares to our North American F-100."

TWA Starts Nonstop L.A.-N.Y. Service

Trans World Airlines started scheduled Super Constellation nonstop transcontinental service last week, nosing out American Airlines, which has been advertising that AA would open this service Nov. 29 with its new Douglas DC-7.

Pointing up transcontinental airline rivalry, American Airlines ferried its first Douglas DC-7 from California to New York nonstop on the same day TWA inaugurated its new nonstop transcontinental schedule.

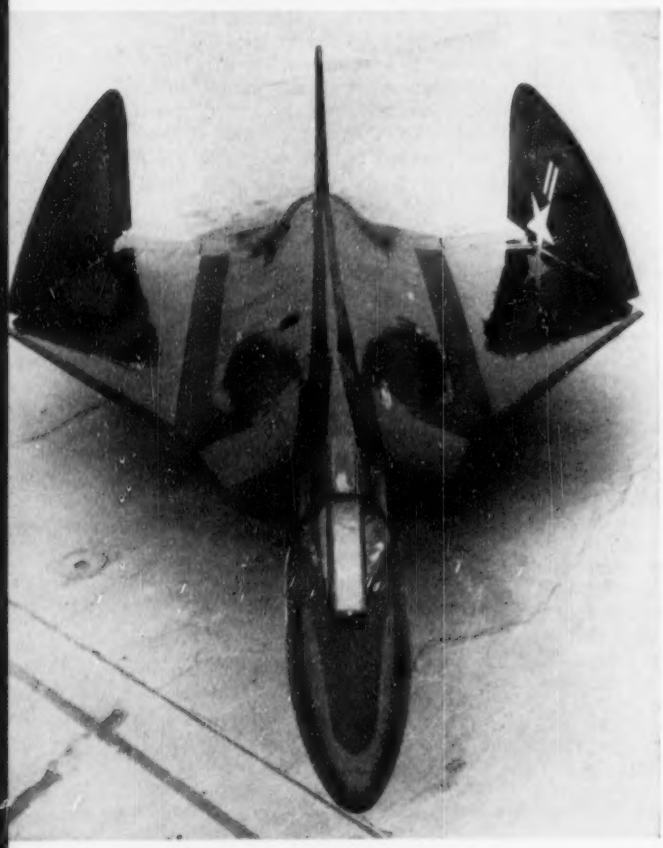
Trans World will fly its new service daily eastbound only; AA plans to run its new Wright Turbo Compound-powered DC-7s in both directions. Industry observers had predicted that TWA would meet the nonstop competition with Super Connie service, at least on eastbound flights (AVIATION WEEK Oct. 12, p. 10).

▶**DC-7 Log**—An indication of how American's DC-7s will perform when they go into service next month was provided AVIATION WEEK by Capt. Hamilton C. Smith, co-pilot on the DC-7 ferry flight last Monday.

Flight took off from Santa Monica at 9:06 (EST), and was over New York International Airport at 15:58 EST. Average speed was 358 mph. with wind varying from calm to a 10-mph. tail wind.

The TWA Super Connie flights leave Los Angeles at 7 p.m. and land at New York International Airport approximately eight hours later. Seating will remain the same as on the carrier's other Ambassador flights—60 passengers if all eight berths are occupied, 64 using seats only. No extra charge will be made for the nonstop Super Constellation service.

Fuel capacity will average approximately 5,300-5,400 gal., leaving some 1,000 gal. in the tanks when the plane arrives in New York. It is expected that the pilots will pull more cruise power from the Super Connie Wright R3350 engines than is used for the transcontinental flights making stops. The TWA Super Connies can cruise at 1,500 hp. with high blower at 19,000 ft., an airline official says.



Douglas Skyray Viewed Close Up

Interesting design features of the record-smashing Douglas XF4D-1 Skyray are detailed in this series of closeup photos only recently released by the U. S. Navy for publication. These pictures show for the first time the Skyray with its wingtips folded to conserve space when stowed on board a carrier. Another noteworthy feature is the unusual carrier arresting gear, detailed in the two bottom pictures. They show that a small tailwheel is fitted in the tip of this installation.

The Skyray features a modified delta wing with slightly swept trailing edges. It spans 33 ft. 6 in. and is 50 ft. long. Intakes in the leading edges of the wing roots feed a single Westinghouse XJ40-WE-8 turbojet, which, with afterburner, delivers 11,600 lb. of thrust for short periods. With this power, Lt. Cmdr. James B. Verdin on Oct. 3 set a new world's absolute speed record of 753.4 mph. over a three-kilometer straight course at Salton Sea, Calif. (Aviation Week Oct. 12, p. 16).

On Oct. 17 Douglas test pilot Bob Rahn flew a Douglas XF4D-1 at an average speed of 728.110 mph. around a 100-km. (62.1 mi.) closed course.

The Douglas Skyray has been undergoing evaluation tests, including carrier suitability trials, at the Naval Air Test Center, Patuxent River, Md. Production models of the plane will be powered by the more powerful P&WA J57 split-compressor turbojet delivering approximately 15,000 lb. thrust. The planes are being built for the Navy at Douglas Aircraft Co.'s El Segundo, Calif. plant.

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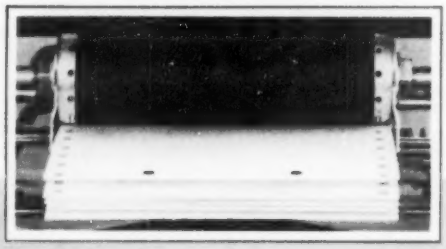

Here is great news for every user of multiple-copy continuous forms! IBM's new Pin Feed Lift Platen enables you to use marginally-punched continuous forms, assuring accurate alignment from line to line and set to set, while enjoying the speed and carbon paper savings of the IBM Electric Formswriter.

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AIA 'No Raid' Pact Draws Fire

Engineers say agreement cuts down bids offered for new talent but fails to stop recruiting program.

Los Angeles—A "no raid" agreement between Aircraft Industries Assn. members—designed to combat expensive competition for engineering talent—is drawing criticism from aircraft engineers who call it an unfair labor practice.

"Prejudicial," "unjust," "unfair" and stronger terms have been used by engineers in describing the pact.

▶ **Back-Patting Pact**—But the so-called "gentleman's agreement" is reported to be more honored in the breach than in observance.

It has been unsuccessful in stopping raids on engineering talent by opposing firms but appears to have reduced expensive bidding for engineers, observers say. The aircraft engineer still can change jobs freely, but he gets paid less for doing it.

"This," said one engineer, "is the gentleman's agreement between gentlemen who are patting each other on the back with one hand while they hold a knife in the other."

"This whole thing makes the engineers as mad as hell," another said.

▶ **Bypass**—The agreement was intended to combat the competitive situation arising from the shortage of engineers. According to information given this magazine, the no-proselyting pact was this: Each company agreed not to hire any engineer still employed by another firm without a release from that firm.

But in practice, it works like this: "A man comes over from Blank Aircraft Co. to talk to us," said one recruiter. "We discuss the situation, he fills out an application. We tell him we can't possibly hire him because he still is working for Blank. But we also tell him, for example, that if we were in a position to hire him, we would pay him $525 a month. He quits, we hire him."

▶ **Salary Downhold**—An agreement to hold down salaries apparently followed when aircraft firms realized the "no raid" pact was being bypassed through subterfuges.

"In our company," said an official who had just returned from a recruiting trip, "we try to keep any increase for an engineer we're hiring down to $50 a month. If possible, we hold it to $25. The other companies follow the same pattern, so this holds down salaries in spite of the shortage."

Like the "no raid" pact, this is unwritten.

▶ **Contract Problem**—"There is a gentleman's agreement not to pirate in each other's area, but this is not an official AIA action," said a spokesman for the Aircraft Industries Assn. "Officially, AIA would be against such a thing."

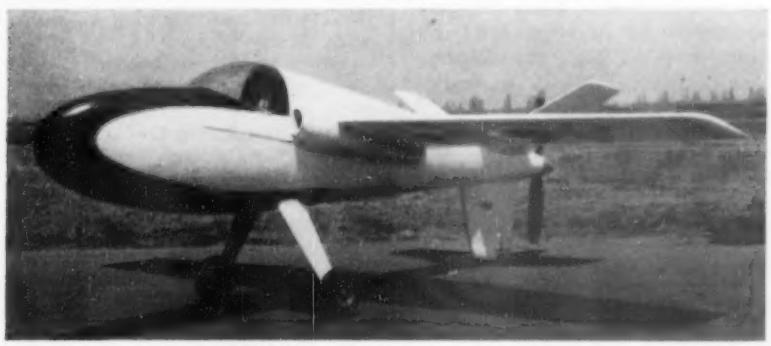
Nevertheless, AVIATION WEEK is told, complaints concerning breaches of the agreement have been aired in AIA committee meetings.

"The trouble is," explained one company executive, "that this is a gentleman's agreement between people who still are faced with a problem which must be solved—when we get a new contract, we have to get new people. How else are we going to get them?"

▶ **Recruiting Practices**—A top engineer, who had just completed a several-week recruiting tour of the East for a major Southern California airframe plant, discussed the situation freely.

The following quotations from his conversation indicate some current recruiting practices:

• "If the Southern California pool is

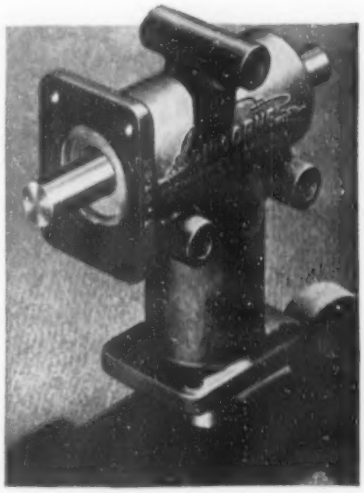


PUSHER RACER HAS Y-TAIL

Radical Sierra S-1 racer built by Acme Aircraft Co., Torrance, Calif., features a pusher propeller turned by an 85-hp. Continental engine. Air cooling intakes are located at the wing roots. Note the Y-tail configuration, with tail wheel located at the bottom, providing clearance for the two-blade prop. Wingspan and length are about 20 ft.

Right angle

TRANSMISSION PROBLEM ?



Before spending time and money on a tailor-made design, investigate ANGLgear. You'll learn why these tiny right-angle bevel gear drives are so widely used. ANGLgears have the capacity of units many times their size. Model R-300 is rated at ⅓ hp at 1800 rpm—Model R-320 at 1 hp. Both models have hardened gears and ball bearings, are lubricated for life. Both are made with 1:1 ratio, and with 2-way or 3-way shaft extensions.

ANGLgears are described fully in the I.A.S. Aeronautical Engineering Catalog. Refer to this publication for complete information, or write us direct.

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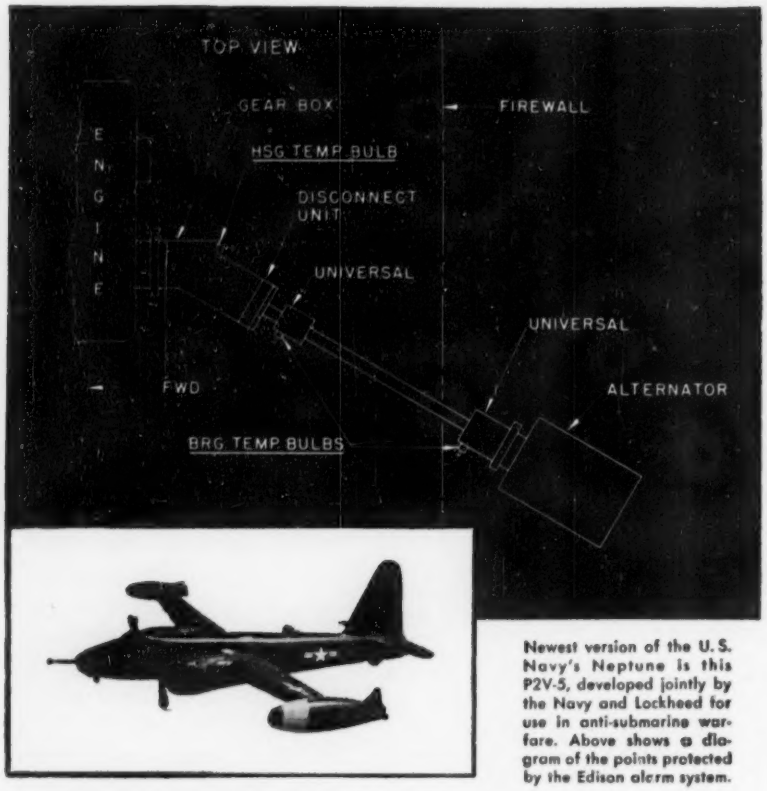
Lockheed Neptune Gets New

Temperature Warning System



Newest version of the U. S. Navy's Neptune is this P2V-5, developed jointly by the Navy and Lockheed for use in anti-submarine warfare. Above shows a diagram of the points protected by the Edison alarm system.

A NEW EDISON Temperature Alarm System keeps its sensitive "fingers" on three spots in the alternator drive system. Should the temperature at any or all spots rise to 150°C, an alarm automatically signals in the flight compartment. The alternator drive system is so designed that it can be immediately disengaged before serious damage can happen.

THREE STANDARD resistance bulbs, a small control assembly (wgt. 1.5 lbs.), and a panel light make up the system. The bulbs are installed as shown in the diagram. Each bulb continuously "feels" the temperature at each point. When the temperature reaches its critical level, the alarm comes on, and, if the temperature returns to normal, automatically shuts off.

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thin, we take a swing through the East. In Chicago, Boston, New York, Dallas, we find plenty of people who want somebody to pay their moving expenses to sunny California. We put a display ad in the classified section of the paper, sit in a hotel room and wait."

• **"We can't go** into Dayton. We have to stay away from Wright-Pat (Wright-Patterson AFB, Dayton). But Chicago is not an airplane town. Can we help it if somebody sees our ad in a Chicago paper and comes up from Dayton? Sure, we pay his expenses."

• **"We follow the contract picture** on cutbacks. If there is a cutback at, say, Convair-Ft. Worth, every smart company will have a rep in a hotel room in Ft. Worth within 24 hr.

• **"We can't set up shop** openly in Seattle, for example, because of the agreement. But we can go up for interviews at the University of Washington. If the word happens to get around through a friend at Boeing that we're in town on a talent hunt and staying at such-and-such hotel, can we help it?"

• **"An ad in the paper** at an engineering convention that a recruiter is there in a hotel room always pays dividends."

The above quotations indicate some ways of getting around the pact.

▶ **Talent Scramble**—The scramble for engineering talent reached such a point, AVIATION WEEK was told, that the producer of one of USAF's new supersonic interceptors demanded an agreement from two subcontractors turning out the same component that they would not raid each other's staff.

The prime producer made the agreement an unwritten part of the subcontract to keep production from suffering at either plant. Nevertheless, it was not long before one subcontractor was complaining that the other had violated the agreement.

Practice on releases varies from firm to firm.

"If a man comes to us and asks outright for a release, we give it to him," said one engineering executive. "We don't want him around if he doesn't want to stay."

Other companies look on it differently. (This has been called the "a body is a body" attitude.)

▶ **Brazen Infringement?**—Complains one engineer: "The only personnel this works to the disadvantage of is the engineer. It fixes his rates and freezes his progression."

Another complained much more warmly with this demand: "Isn't this a brazen infringement upon the constitutional rights of American citizens? Isn't this employing coercion, intimidation, and subterfuge to deprive Mr. U. S. Citizen of his rights to fair employment practices? In short, isn't this an unfair labor practice in the true sense of the word?"—WJC

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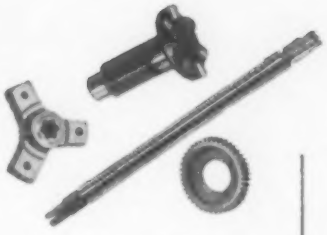

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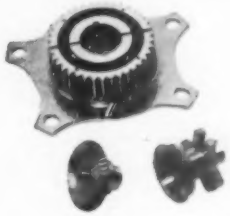

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McDonnell Receives $62,432 Salary

James S. McDonnell, Jr., president of McDonnell Aircraft Corp., received a $62,432 salary for the year ended June 30 plus $8,214 from the company's retirement income plan.

Other McDonnell officers' salaries reported to the Securities & Exchange Commission in Washington, including company contribution from the retirement income plan, were:

C. Warren Drake, vice president-manufacturing, $33,806 plus $3,034; Robert H. Charles, vice president-contracts, $31,757 plus $2,526; Kendall Perkins, vice president-engineering, $26,403 plus $2,461; and Don R. Berlin, former vice president and general manager who resigned from the company Dec. 15 to become president of Piasecki Helicopter Corp., $25,779.

Income received by officers and directors from McDonnell totaled $297,418 in salaries, $24,999 in benefits.

FTL Reports Salaries

Robert W. Prescott, president of Flying Tigers Line, received $38,200 salary during 1952, the cargo carrier reports to the Securities & Exchange Commission. Flying Tiger officers and directors received a total of $129,000.

Civilian Aircraft, Engine Shipments

	August 1953	July	August 1952	Cumulative Totals January-August 1953	1952
Complete aircraft	350	402	349	3,015	2,357
By weight of airframe:					
Less than 3,000 lb.	330	378	322	2,819	2,056
3,000 lb. and more	20	24	27	196	301
By number of places:					
1- to 5-place	330	378	322	2,819	2,055
More than 5-place	20	24	27	196	302
By total rated hp., all engines:					
Up to 399 hp.	330	378	322	2,819	2,055
400 hp. and more	20	24	27	196	302
Total value of complete aircraft and parts (000 omitted)	$25,173	$21,637	$21,461	$203,371	$176,055
Aircraft total	17,961	23,117	13,705	141,310	125,103
Less than 3,000 lb.	2,866	3,514	2,523	24,011	15,329
3,000 lb and more	15,095	19,603	11,182	117,299	109,774
Aircraft parts	7,212	8,520	7,756	62,061	50,952
Total value of aircraft engines and parts, (000 omitted)	$12,969	$12,749	$10,091	$96,653	$96,875
Aircraft engines	6,109	6,583	2,510	41,487	27,704
Engine parts	6,860	6,166	7,581	55,166	69,171
Unfilled orders (3,000 airframe lb. and more)	346	353	573		

Civil Engine Shipments Climb 5%

Civil Aircraft shipments dropped 19% during August, while engine deliveries increased 5%, Census Bureau and Civil Aeronautics Administration report in a joint statement.

The industry shipped 350 civil aircraft weighing 824,400 lb. and valued at $18 million in August. During July, shipments totaled 402 planes valued at $23.1 million.

August engine shipments amounted to 609 powerplants totaling 378,500 hp. and valued at $6.1 million. In July, the aircraft industry shipped 579 engines totaling 400,900 hp.

During the first eight months of 1953, the industry shipped 3,015 aircraft weighing 6,821,600 lb., and valued at $141.3 million. In the same period of 1952, value of civil aircraft shipments was $125.1 million.

Engines shipped in the first eight months increased 28% in number, 34% in horsepower and 50% in value, compared with shipments last year.

The 21 companies operating 24 plants surveyed for the month of August reported a backlog of 346 aircraft, a decrease of seven planes from the backlog at the end of July.

THE BUBBLE THAT SPOTS SUBS

SECRET of the deadly effectiveness of the Navy's new anti-submarine blimp—built by Goodyear Aircraft Corporation—lies in the "bubble" underneath its belly.

Called radomes, these electro-magnetically transparent enclosures are the largest ever flown—they house the search radar of these newest sub-hunters.

Goodyear Aircraft, pioneer of void-free laminated plastic sections for aircraft, solved a special problem on these large blimp radomes.

To permit access, the bottom section of the radome — normally made of glass fabric and resin — was specially designed of rubberized fabric with a "zippered" manhole. The entire enclosure is pressurized to maintain the aerodynamic contour of the diaphragm in flight.

This radome is one of the reasons the fast new fleet of Navy N-Ships can track and quickly destroy enemy submariners who venture too close to our shores.

Whether the job is one of building blimps, radomes, radar structures, complete airplanes or any of their countless components—Goodyear Aircraft has long proved its ability and versatility in the service of the aeronautics industry. Goodyear Aircraft Corporation, Department 65, Akron 15, Ohio.

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A three million pound stretch will literally pull back into shape, large aircraft sections —straightening and relieving strains that result from the heat-treating process. The stretcher, itself, will weigh better than two million pounds, will be about 180 feet long and fully capable of handling pieces of metal up to 110 feet in length! At peak loads in the stretching operation, the forces exerted by this machine are so great that the 138-foot, 123-ton stretcher column may shorten as much as 3/8 of an inch!

Its three million pound pull is equal to that of thirty-eight large diesel locomotives!

During the quench in cold water following the solution heat treatment, internal stresses are created. Removing these residual strains and straightening the parts are accomplished with this stretcher. It will straighten shapes with a cross-sectional area up to 60 square inches—made of one of the strongest of all aircraft alloys, 75S.

With Alcoa's extrusion presses—those in operation and those now being built—this new stretcher will make possible larger, yet over-all lighter, more intricate aluminum parts for American aircraft.

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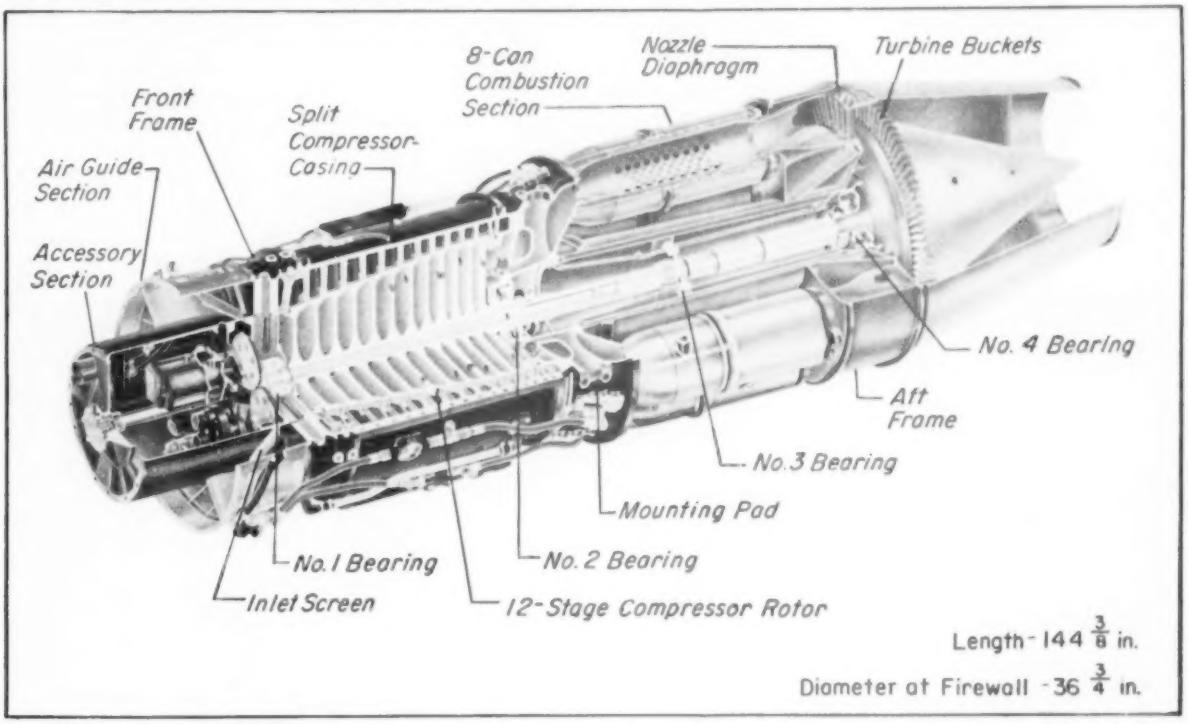


Analysis Bares J47 Jet Design Details

First overall study reveals makeup of GE engine that has racked up more than a million flight hours.

The General Electric J47 turbojet in its various models is the powerplant for a string of Air Force fighters and bombers, including various versions of the F-86 and B-47. It provides the jet thrust in the jet-pulse-piston B-36.

Since the basic design of the engine was laid down some years ago, it has racked up more than one million flight hours. But its overall details are revealed for the first time in a paper that has been prepared recently by R. E. Small, of GE's Aircraft Gas Turbine Division.

Front End

The forward end of the J47 is made up of the air-guide section and the accessories-and-drive section.

Air-guide section includes the air-guide sectors and island covers and fairings. The island covers are used as junction points for fuel, lube oil, anti-icing air, and throttle and certain electrical connections. The connecting lines are brought out radially through the inlet air stream by passing through the four island fairings. Some of the J47 models incorporate retractible inlet screens in the air-guide sectors.

The compressor front frame accommodates the accessory drive mechanism, support for No. 1 bearing, inlet guide vanes, and the balance piston chamber.

▶ **Air Inlet**—The frame is made up of an inner and outer section forming the annular passage for the air inlet. Eight struts connect the inner and outer sections.

The inlet guide vanes—hollow blades mounted between two concentric rings—are anti-iced. They are attached to the rear side of the front frame's center section along with an oil and air seal assembly. The air seal acts along the outer diameter of the compressor first-stage wheel. The oil seal acts at the compressor rotor hub.

The space between the two seals forms the balance piston chamber. This is supplied with 12th-stage air through the hollow inlet guide vanes. Air acting against the forward end of the compressor rotor counteracts some of the rotor's forward thrust, Small reveals.

▶ **Accessory Drives**—Accessory drive gears for the auxiliary components are installed in the compressor front-frame center-section. The auxiliary components are mounted on front frame pads and splined to reduction gears, which mesh with a pinion on a common driveshaft coupled directly to the compressor rotor.

Auxiliary components include a starter-generator, tachometer generator, fuel regulator, fuel pump, lube and scavenge pump, and stopcock. Another scavenge pump is located inside the compressor rear frame.

Compressor

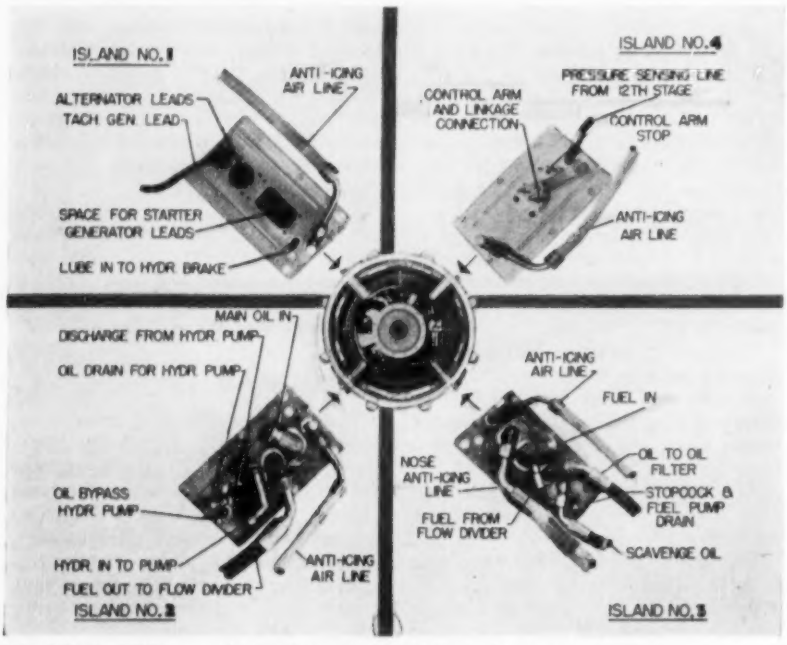
The J47's original compressor rotor design consists of 12 wheels shrunk on a steel shaft. First 9 of these stages are machined from 14S aluminum forgings. The last 3 are made from heat-treated 410 chrome-steel forgings, to withstand the higher temperature of the compressed air. The forged compressor rotor blades are attached to the disk rim with dovetails.

The wheel rims are connected by

Aircraft Powered by GE's J47

Manufacturer	Aircraft	No. of Engines	Engine Model
North American	F-86A**	1	J47-1 or -7
	F-86D*	1	J47-17 (afterburner model)
	F-86E**	1	J47-13
	F-86F*	1	J47-27
	FJ-2*	1	J47-2
Boeing	B-47A**	6	J47-11
	B-47B*	6	J47-23 or J47-25 (water-alcohol takeoff augmentation)
	B-47E*	6	J47-25 (water-alcohol takeoff augmentation)
Convair	BB-36D, E, F*	4	J47-19 in addition to 6 turbo-supercharged P&W R-4360s
	B-36D, F*	4	J47-19 in addition to 6 turbo-supercharged P&W R-4360s
North American	B-45A**	4	2 J47-1, 2 J47-3; or 2 J47-7, 2 J47-9
	B-45C**	4	2 J47-13, 2 J47-15
Republic	XF-91**	1	J47-23 modified for afterburner
Martin	XB-51**	3	J47-13 modified
Chase	XC-123**	4	J47-11

* *In production.*
** *Production completed.*



ISLAND COVERS provide junction points for front end accessory connections.

J47 Production Status

Several models of the J47 turbojet engine are in production at General Electric plants at Cincinnati and Lynn, Mass. One model is being produced by both Packard Motor Car Co. and the Studebaker Corp.

Close to 20,000 J47s have been built by the two GE plants.

cylindrical spacer rings fitted under the wheel shoulder. Each ring is secured to an adjoining wheel rim by steel pins to carry the torque. Between stages 1 and 10, the spacer rings on the original compressor rotor are made of 14S; between stages 10 and 12 the spacer rings are made of 405 chrome-steel.

▶ **Improved Rotor**—Small reveals that an improved type of compressor rotor construction is in production for the later J47 models. This is a new curvic-coupling arrangement for more efficient torque transmission and for prevention of circumferential shift of the wheels.

Rotor assembly and disassembly also is greatly simplified—compressor wheels are splined together rather than shrunk on a shaft. The wheels are geared on both sides, meshed together and secured with axial tie-bolts. Removal of bolts permits quick disassembly of the rotor, Small claims.

The cast 355 aluminum compressor casing (stator) is horizontally split into half-sections bolted together and secured at the ends to the Dow-C magnesium front frame and the 355 aluminum compressor rear frame. Front and rear frames, forming the main mounting structure, are not split.

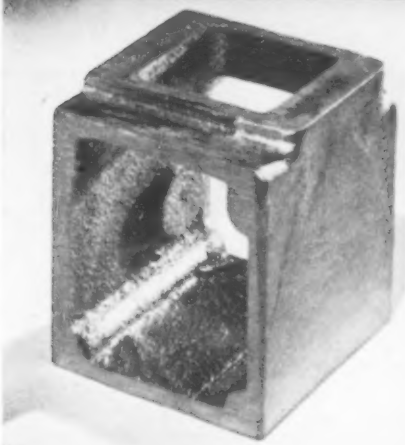
The compressor rear frame supports the front end of the combustion chambers and also serves as a support for the No. 2 bearing.

Four engine mounting pads, two on the horizontal and two on the vertical centerlines are located on the compressor rear frame.

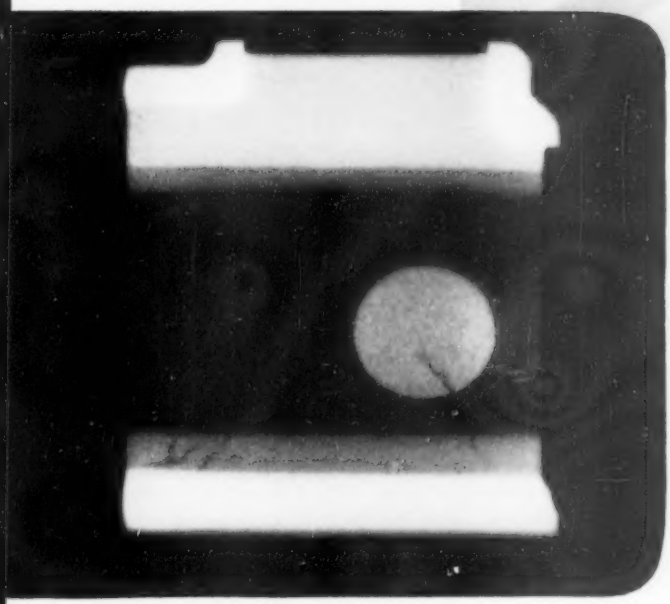
▶ **Stator Blade Types**—Small reveals that to obtain maximum producibility, four types of compressor stator blades are released for production engines:

- **Precision-forged blades** are dovetailed into split rings which are assembled into the stator halves.
- **Sintered units** have been tested and released for production.
- **Cast blades** have been tested and released for production.
- **New fabricated type** also is being used now in production engines. The material is rolled in long strips, contoured to the proper airfoil section and then cut to the desired length. This airfoil is welded to a base so shaped that it fills the same area as the present blade ring, thus eliminating the ring and an

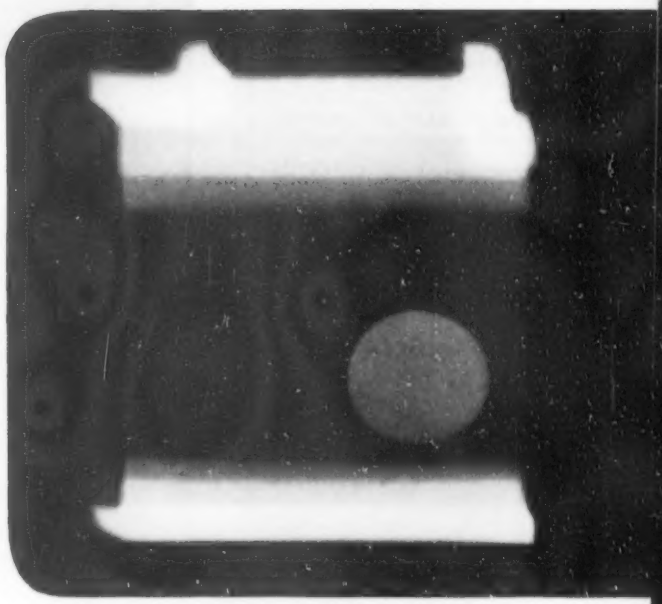
When shrink occurs...



Yield shrinks, too...



Radiograph shows recurring defects due to shrinkage.



A change in gating produced sound castings.

Radiography helps avoid shrink

Shrink can pose a real problem in casting 355 aluminum. It did with this instrument housing.

But radiographs of the pilot runs showed a recurring pattern of defects. This suggested a change in gating which quickly corrected the difficulty.

This is a typical reason why more and more foundries are making full use of radiography. It proves the soundness of their work—helps build a reputation for prompt delivery of good castings.

If you'd like details on how Radiography can improve your operations, get in touch with your x-ray dealer. Or, write us for a free copy of "Radiography as a Foundry Tool."

EASTMAN KODAK COMPANY
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Radiography...

another important function of photography

Kodak
TRADE-MARK

HERE IS THE SOLUTION

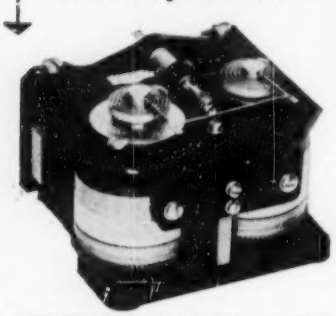
to many metering and positioning problems requiring extreme sensitivity *and* extreme durability.

Texas Instruments originally developed this sensitive, smooth, linear and long-lived **magnetic fluid clutch meter/positioner** to solve a 30° bi-directional recording problem in some airborne military gear. Simply and durably built, it far outlasts anything similar we've ever seen (over 3000 hours continuous duty at rated load).

In essence, it consists of two TI-developed magnetic fluid clutches (weighing .46 lb each) working in opposition. Input current of 100 microamps causes a 6° output shaft deflection with from 10 to 500 microamps being measurable. General data is appended.

If *you* are being perplexed by a metering/positioning problem demanding a rugged — yet sensitive and accurate — movement, just drop us a line and we'll be glad to answer your questions in detail.

TI magnetic fluid clutch meter/positioner



SPECIFICATIONS

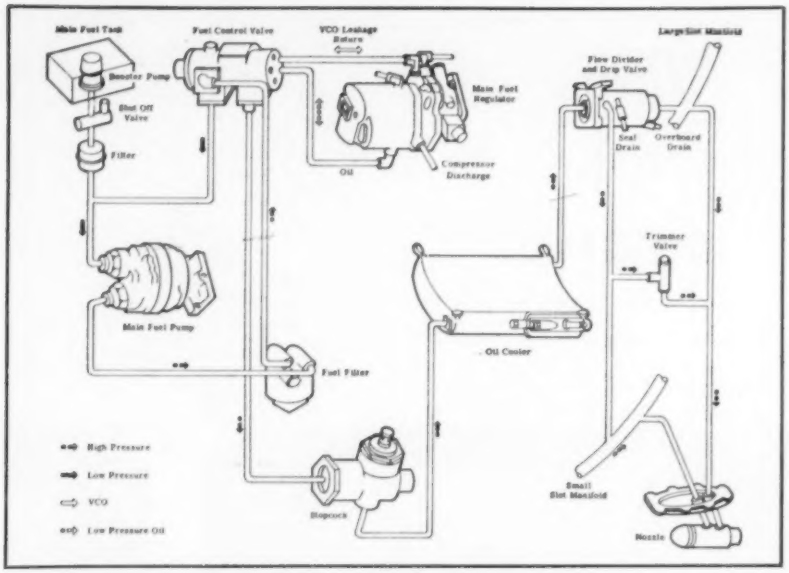
Meter/Positioner Movement

Sensitivity	6° per 100 microamps
Accuracy	±5%
Life	3000 hr @ rated load
Frequency Response	Flat to 5 cps, as applied
Deflection	30° either side of zero
Min. Input Signal	10 microamps
Max. Input Signal	500 microamps
Ambient Temp. Range	−40 to +75° C
Coil Impedance	15,000 Ω, 450 henries

following data taken w/o springs

Output Torque	0.125 oz-in./100 microamps
Maximum Output Torque	5.25 oz-in. at 4 milliamps

TEXAS INSTRUMENTS
INCORPORATED
6000 LEMMON AVE. DALLAS 9, TEXAS



J47 Fuel and Control System (see p. 40).

expensive manufacturing and assembly process, Small explains.

The fabricated stator blade, he says, also provides increased resistance to vibration, gives an appreciable reduction in blade cost, and affords a critical materials saving.

► **Carried on Casing**—Mounted on the stator casing are components of the various engine systems:

• **Electrical units** carried include the main junction box, vibrator, ignition coils, inlet screen actuator, emergency fuel regulator solenoid, and anti-icing valve.

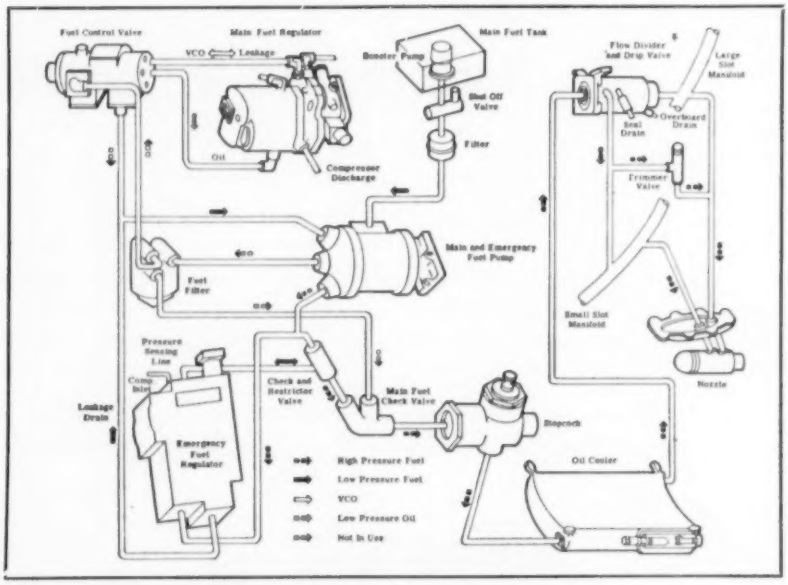
• **Fuel system** components supported on the casing include the emergency fuel regulator, flow divider and drip valve, small slot manifold, large slot manifold, and fuel piping.

• **Lube system** units on the casing include the oil cooler, oil filter, and lube piping.

Combustion Section

The eight combustion chambers are supported at the front end by the compressor rear frame and at the rear end by the turbine frame. Quick-disconnect rings are used at the ends to facilitate disassembly.

The combustion chamber assembly consists of an outer chamber and a removable inner liner with openings to permit compressed air to enter from



Emergency System in Operation (see p. 42).

REM-CRU TITANIUM

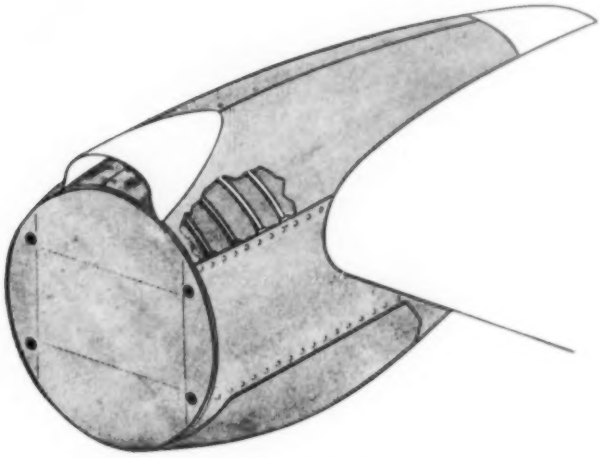
facts about a new metal for the aviation industry

TITANIUM is superior to other structural metals in terms of strength-to-weight ratio. And its corrosion resistant properties are remarkable, too. To acquaint you more fully with its characteristics, here are other facts about this new ductile metal.

Engine nacelles and firewalls of the new Douglas DC-7 superliner will consist of Rem-Cru RC-70 titanium sheet.

Forming Properties—You can form airframe sections of titanium on the same equipment you use for forming stainless steel. Most forming of RC-70, the standard commercially pure grade of REM-CRU titanium, is done at room temperature. More difficult forming operations with RC-130A, a titanium alloy, are usually carried out at moderately elevated temperatures such as 500-900 F. The forming is best done slowly, without rapid or severe deformations.

You can also shear and punch titanium with the same die setup as you use for stainless steel. Titanium parts can be stretch-formed, or formed on a hydro-press or drop hammer. But in the latter two cases you should perform the work at moderately elevated temperatures.



Shaded areas show where Rem-Cru titanium is used in DC-7 nacelles

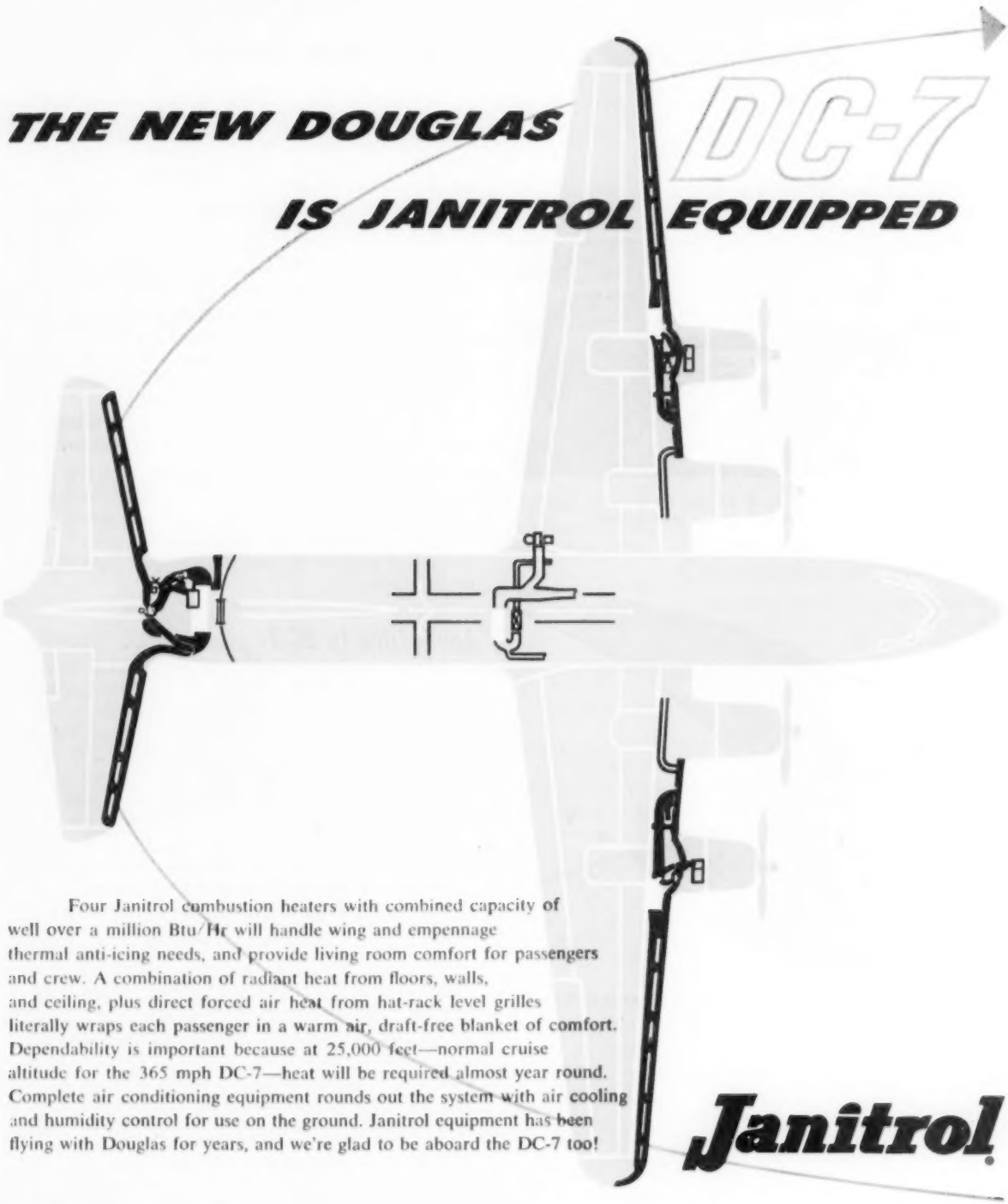
Application to DC-7—A good example of the use of titanium is provided in the new Douglas DC-7 airline transport. Here the use of REM-CRU titanium in place of aluminum alloys and stainless steel in nacelles and firewalls effects weight savings for the Douglas Aircraft Company of approximately 200 pounds per airplane. These sections are formed from RC-70 sheet, in gauges varying from .016″ to .060″ and lengths up to 120″. Douglas stretch-forms the nacelle skin at room temperature. They shape ribs and stringers by brake or roll-forming, then stretch-form them to the proper curvature. In the assembly operations Douglas both spot welds and rivets the titanium sections.

Availability—REM-CRU—a principal producer of titanium—makes bars, plates, sheet, strip, wire, tubing, forgings and billets in four grades. RC-55 and RC-70 are commercially pure grades; RC-130A and RC-130B are titanium-base alloys. We are currently expanding melting and mill facilities so that within a year our production will increase several fold.

To keep abreast of the latest developments on this vital metal, write for the Rem-Cru Review—a free periodical devoted to the application and fabrication of titanium and its alloys.

REM-CRU TITANIUM REM-CRU TITANIUM, INC., MIDLAND, PENNSYLVANIA

THE NEW DOUGLAS DC-7 IS JANITROL EQUIPPED



Four Janitrol combustion heaters with combined capacity of well over a million Btu/Hr will handle wing and empennage thermal anti-icing needs, and provide living room comfort for passengers and crew. A combination of radiant heat from floors, walls, and ceiling, plus direct forced air heat from hat-rack level grilles literally wraps each passenger in a warm air, draft-free blanket of comfort. Dependability is important because at 25,000 feet—normal cruise altitude for the 365 mph DC-7—heat will be required almost year round. Complete air conditioning equipment rounds out the system with air cooling and humidity control for use on the ground. Janitrol equipment has been flying with Douglas for years, and we're glad to be aboard the DC-7 too!

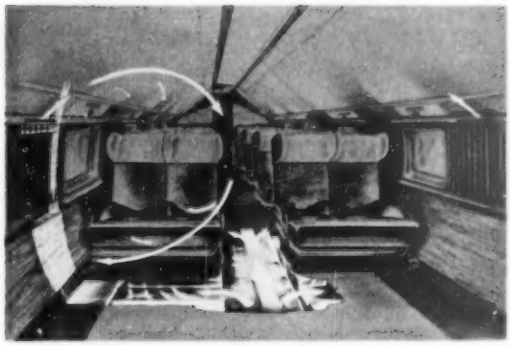
Janitrol

AIRCRAFT-AUTOMOTIVE DIVISION, SURFACE COMBUSTION CORPORATION, TOLEDO 1, OHIO

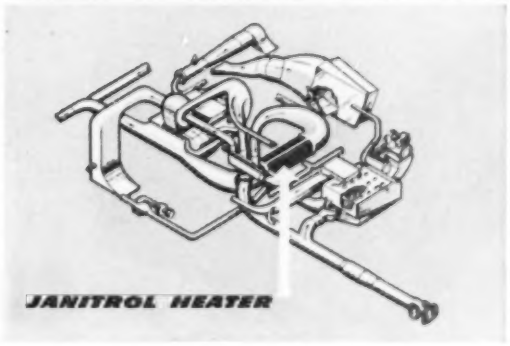
National Sales, Engineering, Production Headquarters, 400 Dublin Ave., Columbus 16, Ohio. District Engineering Offices: New York, 225 Broadway; Washington, D. C., 4650 East-West Highway; Kansas City, 2201 Grand Ave.; Ft. Worth, 2509 West Berry St.; Hollywood, Calif., 7046 Hollywood Blvd.; Columbus, Ohio, 400 Dublin Ave. Executive Offices: 2375 Dorr St., Toledo 1, Ohio.

great new DOUGLAS DC-7 transport features living room comfort at all times

American Airlines, Delta – C. & S. Air Lines, National Airlines, and United Air Lines have already ordered more than sixty DC-7s – a tribute to Douglas dependability and economy, and to Janitrol too, since the great majority of Douglas planes have been Janitrol combustion heater equipped for years.



Cutaway illustration of cabin airflow system. Flow arrows show how each seat is wrapped in warmth. Same ductwork circulates conditioned air for cooling.



Schematic of cabin heat, and air conditioning refrigeration installation under cabin floor. All four heaters on the DC-7 are alike, with complete interchangeability of plug-in accessory components throughout for simplicity of service and maintenance work.

Janitrol

36 years experience in combustion engineering

for today's "hotter" jets, *South Wind* presents...

new lightweight, thinwall

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To meet the challenge of higher temperatures in advanced jet engines, South Wind has developed new lightweight, thinwall stainless steel heat exchangers. These heat exchangers fully comply with the rigid specifications set up by airframe and engine manufacturers, as well as the makers of air cycle cooling packages.

In addition to stainless steel, thinwall aluminum heat exchangers also are being designed and fabricated at South Wind for many different applications. Heat transfer from air-to-air, liquid-to-liquid, and air-to-liquid is being achieved effectively with the new South Wind heat exchangers, which utilize either the tube bundle or the plate and fin types of design . . . whichever the job requires.

*Illustrated here is a thinwall stainless steel tube bundle heat exchanger

For Aircraft Heating OR Cooling

Pioneers in the field of aircraft heat exchange equipment for providing heat, South Wind has now put that experience to work in the development of heat exchangers for cooling purposes . . . another service to the aircraft industry.

"Can Do!"

Whatever *your* need in heat transfer equipment, South Wind's experienced engineering staff will be glad to consult with you. For information, write Stewart-Warner Corporation, South Wind Division, 1514 Drover Street, Indianapolis 7, Indiana.

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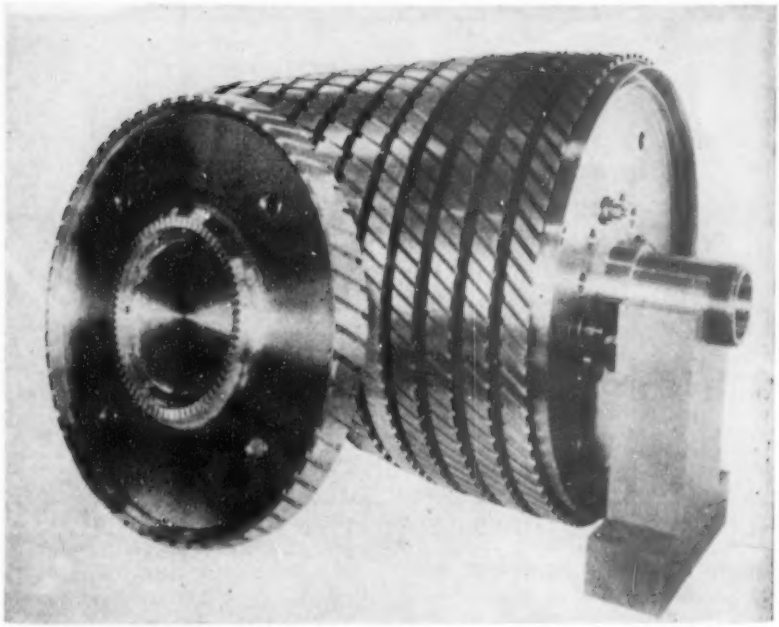
AIRCRAFT HEATERS
HEAT EXCHANGE EQUIPMENT
INERT GAS GENERATORS



CURVIC-COUPLING simplifies rotor assembly and disassembly, insures efficient transmission of torque. Gearing on wheel face meshes with adjacent wheel.

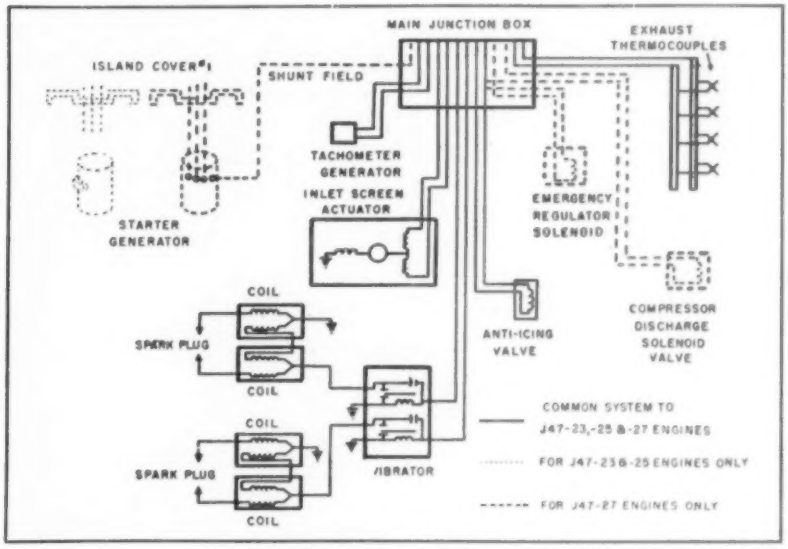
the outer chamber. A fuel nozzle at the chamber front end supplies atomized fuel. Small reveals that ceramic coatings on combustion liners have been released to production.

► **Combustion Process**—During combustion, some compressed air is admitted to the liner at the dome or cap. The balance of the air is fed to the liner throughout its length through holes and louvers. This cools the liner and reduces the temperature of the hot gases. Burning is complete before the gases reach the turbine nozzle.

Ignitor plugs are positioned in two of the eight chambers. Cross-ignition tubes connect the combustion chambers at their forward ends. Inserted in these tubes are inner crossover tubes, linking the individual inner-liners and permitting flame propagation from one chamber to the next.

Inconel transition pieces at the aft end of each chamber conduct the hot gases to the turbine nozzle diaphragm.

The aft frame, bolted to the compressor rear frame, supports the turbine and exhaust assemblies. It also embodies the support plates to which the combustion chambers are attached. It is a fabricated assembly of 321 stainless steel and utilizes internal longi-



J47 Electrical System (see p. 38).

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Resistance Bulbs
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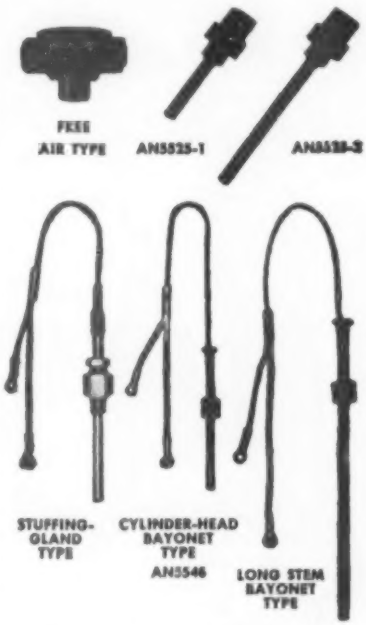
FOR BEST RESULTS USE THESE ACCURATE, RESPONSIVE, STURDY TEMPERATURE-SENSING ELEMENTS WITH LEWIS RESISTANCE-TYPE THERMOMETERS.



Free-air bulb is designed for flush mounting with the wing surface.

AN5525-1 and AN5525-2 standard type with ⅝—18 threaded head, hermetically sealed. These bulbs exceed the response and operating temperature requirements of specification AN-B-19.

Stuffing-gland Type with ⅛ NPT threads, is suitable for measuring liquid temperatures.

Cylinder-head Bayonet Type has probe dimensions similar to the familiar bayonet thermocouple and is used with same AN4076 fitting. Sensitive silver tipped element and sturdy spring insure fast, accurate temperature indication.

Long-stem Bayonet Type, used with AN4076 fitting, is similar in construction to the cylinder-head type except probe is 3⅜ inches longer, for special applications.

In addition to those illustrated, we manufacture bulbs for special applications to individual specifications.

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½" Diam. for strokes up to 3"
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NOW FOR THE FIRST TIME...a rugged Potentiometer that will give long, noise-free performance when subjected to vibration, dither and other environmental conditions.

Absolute precision linearity with clear, sharp signal, because the Humphrey unit is exclusive in internal design. It is fully tested and has been qualified for use in many military applications. Humphrey design service is available to meet your special requirements.

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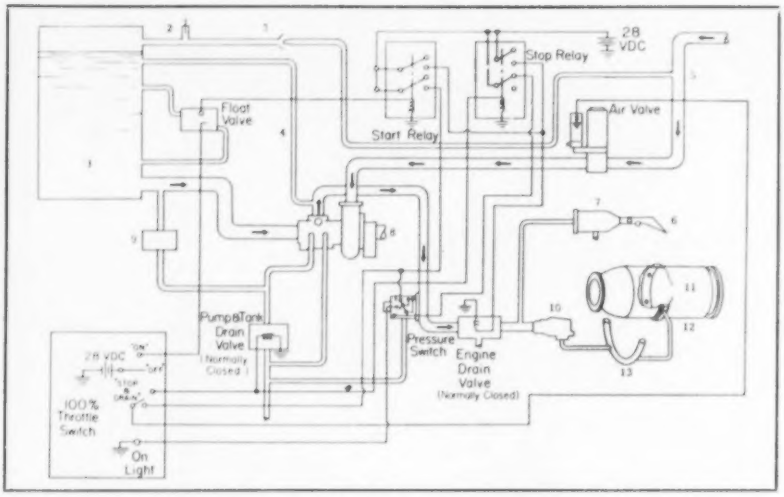


J47 Water-Alcohol Injection System.

tudinal hat section stiffeners, according to Small.

► **Water-Alcohol Injection**—One model of the J47 (the —25) is equipped with water-alcohol injection for thrust augmentation. The water-alcohol mixture is injected through four nozzles located circumferentially around each combustion chamber.

These nozzles are fed from individual manifolds located around each chamber, and are fed from a single manifold surrounding the engine, Small explains.

Turbine & Exhaust

The J47 turbine assembly is a single-stage unit.

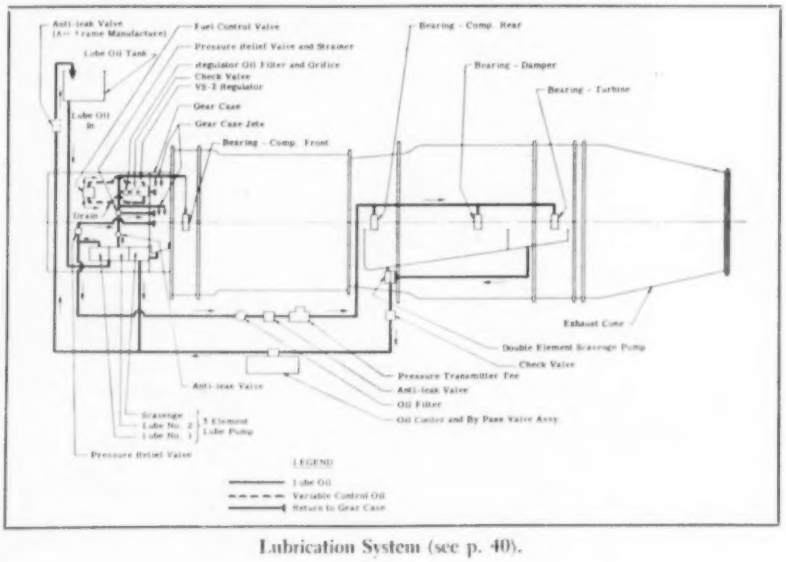
Turbine rotor and compressor rotor shafts are joined with a splined fit between the 12th-stage compressor wheel and the front end of the turbine shaft. Locking of these parts is accomplished with a bolt which runs through the hollow turbine rotor shaft.

The turbine shaft is supported by two bearings—the No. 3 or damper bearing at the mid-section of the shaft, and the No. 4 bearing at the wheel end of the shaft. Turbine buckets are forged from heat-resistant S-816 alloy and dovetailed into the wheel rim. The buckets are not shrouded.

► **Turbine Wheel**—The turbine wheel is made up of a ring of Timken 16-25-6 stainless welded to a 4340 steel hub. Front face of the wheel is cooled by air extracted from the 8th stage of the compressor. The rear face is cooled by air from the 12th stage.

The nozzle diaphragm consists of inner and outer rings of 321 stainless, between which 64 cast blades are welded.

Removal of the exhaust cone, turbine wheel and nozzle diaphragm for inspec-

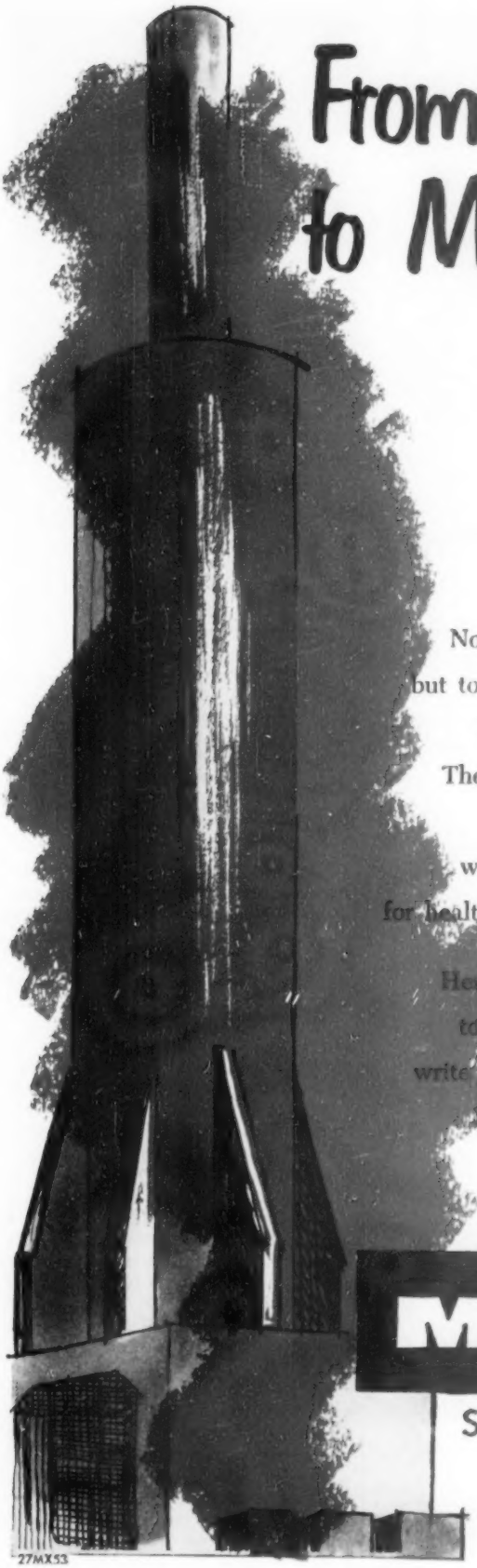


Lubrication System (see p. 40).

From MAXIM to Mars ?

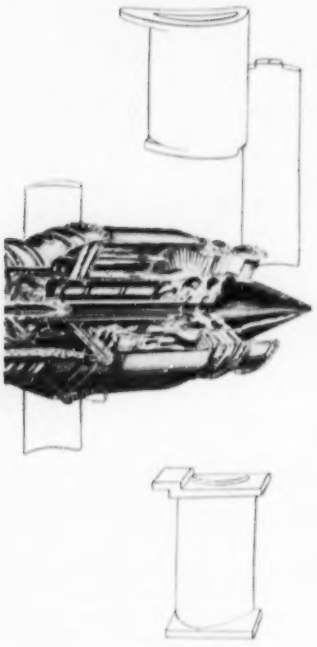
Not Buck Rogers space ships, ready for take off, but tough, noise-killing Maxim Silencers at the Wright Aeronautical Division of Curtiss-Wright. They're important—to everyone working there and to neighbors, too. One prerequisite for working with jets is top-notch exhaust silencing—for health reasons and, obviously, for personnel efficiency.

Here is another example of Maxim's contribution today to the aircraft field. For more information, write to: THE MAXIM SILENCER COMPANY, 215 Homestead Avenue, Hartford 1, Connecticut



MAXIM

SILENCERS



Oddly enough, the metal fabricating process first used to produce cobalt-chrome dentures helped put the "bite" into World War II bombers. The tiny power blades in the turbo-superchargers of high-flying B-17's and B-29's that provided extra speed and longer range were precision cast from high-temperature alloys by the unique Microcast Process.

Originated in 1929 by Austenal Laboratories, Inc., to cast non-machineable alloys, the Microcast Process today is used to produce parts and components from a wide range of ferrous and non-ferrous metals.

The Microcast Process offers exceptional opportunities in the mass production of parts and components. Product improvement through the use of better alloys, economies through the elimination of expensive machining operations, and greater freedom of part design are only a few of its advantages. Investigate Microcast today . . . it may well be the means of a better product at lower cost for you.

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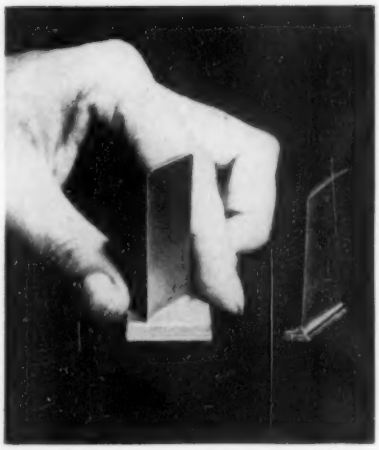

FABRICATED compressor stator blade (left) is cut from long strip and welded to base that takes place of base ring.

tion or replacement, without complete engine disassembly, is a feature of the design, Small says.

► **Exhaust Section**—The exhaust cone is bolted to the turbine casing. The inner cone is suspended from four rods secured to the outer cone.

The exhaust pipe and nozzle are supplied by the aircraft manufacturer, except in the case of the afterburner model engine, where the burner and the variable-area-jet nozzle are a part of the engine.

Electrical

Electrical system consists of the starter-generator circuit and the ignition circuit. The starter-generator is a direct-coupled 24-v d.c. unit running approximately at engine speed. During ground starts, it functions as a d.c. motor to accelerate the engine to speeds for firing —about 550 rpm., Small says. He explains that the starter provides additional torque up to about 1,700 rpm. to assist the engine in accelerating to a minimum stable idling speed—2,200 rpm. When the engine reaches about 3,500 rpm., the starter-generator supplies a continuous generator load of 300 amp. and 24 v.

In addition to a starter control, a voltage regulator is included in the airframe. There is a reverse-current relay to switch from starter to generator and to protect against a reversal of current from batteries to the starter-generator when it is operating as a generator.

► **High-Altitude Starts**—The high-energy, high-voltage spark in both the No. 3 and No. 7 combustion chambers takes place between the tips of two separate single-electrode ignitors. Neither of these is at ground potential—both are "hot," although opposite in polarity. These opposite polarity voltages are

PILOT PROTECTION AGAINST "G" FORCES

Aro's new "Anti-G" Valve plays a vital role in today's protection of jet pilots.

This valve links the pilot's "Anti-G Suit" to a supply of compressed air. Any sudden change in "G" force (gravity or centrifugal force caused by turns, dives or climbs) opens the valve. Air accurately metered for the existing flight conditions is admitted to the "G" suit bladders, creating pressure on the legs, thighs and front abdomen. This pressure prevents the pilots blood from rapidly draining from his head down into his body thus preventing "blackout".

For further details on this "Anti-G" valve and other high-precision aircraft products produced by Aro write:

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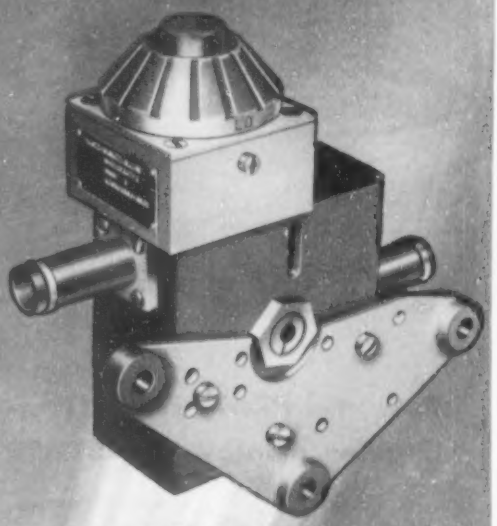

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"ANTI-G" VALVE
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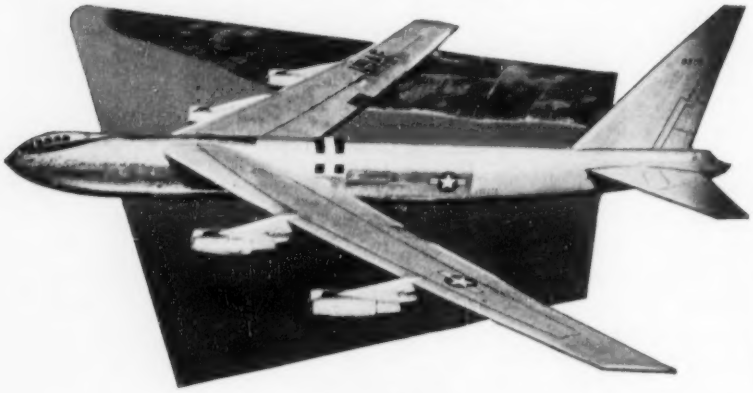

Its EIGHT
Powerful PRATT & WHITNEY AIRCRAFT J-57
Engines employ INVESTMENT CASTINGS by

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Today, when aircraft and aircraft engine builders alike demand the utmost in dependable precision castings, they look to Misco for accuracy, large volume, and substantial production savings.

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The Misco Precision Casting Process, with rigid dimensional and metallurgical control, X-Ray and Zyglo inspection, affords every assurance that customer requirements are met.

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generated by operating two identical ignition coils back to back.

The ignition system is energized only during the few seconds necessary to ignite the air-fuel mixture. Ignition for the other six chambers is obtained by flame travel through the cross-ignition tubes, and combustion is self-sustaining.

With this high-potential ignition system, high-altitude starts are possible. The ram effect of air due to the forward speed of the plane causes the engine to windmill at a substantial speed; air re-starts are made by energizing ignition system and advancing the throttle.

Lube System

The lubrication system is a recirculating positive-displacement type, composed of a three-element lube and scavenge pump, a double-element rear-bearing scavenge pump, oil cooler, oil filter, check valve and oil jet.

▶ **Oil Path**—Tracing the oil flow, Small explains that oil from the airframe-mounted tank enters the main lube pump through No. 2 island. Element No. 1 sends oil under pressure out through No. 3 island, through the oil filter to the compressor rear frame. A separate jet is used to lubricate each bearing (No. 2, 3, 4). A lube-oil breather is mounted on the turbine frame housing to maintain a slight vacuum.

Oil is scavenged from the aft section of the engine by the two-element rear-bearing scavenge pump. Its discharge passes through the lube oil cooler and into a scavenge manifold on the No. 3 island. Fuel is the coolant in the oil cooler, Small reveals.

Element No. 2 of the main pump sends oil into main gearcase passages, and then into five jets lubricating the gears and front compressor bearing. From this system, oil is bled for the operation of the fuel regulator. Oil from the jets, fuel regulator, and the two pressure-relief valves passes into a sump in the compressor front frame. From here it is pumped into the scavenge manifold on the No. 3 island by the scavenge element of the three-element pump. The scavenge manifold passes oil back to the tank.

▶ **Leakage Control**—Static leakage is minimized by means of four check valves, one in each of these lines:

- **Outlet passage** of the No. 2 lube element in the gearcase.
- **Line to the rear bearing** from the No. 1 lube element.
- **Discharge line** from the rear scavenge pump.
- **Oil supply** to the regulator.

Fuel & Control

The fuel regulator is the governing device of the fuel control system.

It determines the variable control oil

LEAR GIVES SURE CONTROL FOR COWL FLAPS

ON CONVAIR 340

To MATCH its exceptional ability to "get up and go," the versatile Convair Liner 340 needs precision control of its engine cowl flaps. Positive action and exact positioning for this important function are provided by Lear screwjacks.

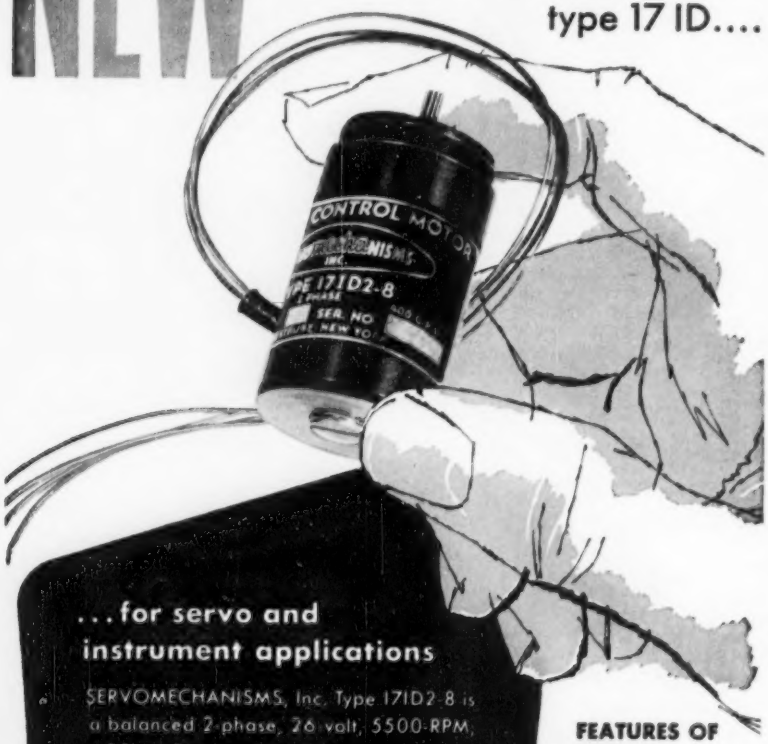
Lear screwjacks form but one part of a comprehensive line of Lear electro-mechanical actuating products for aircraft use. Their compact design, light weight, high strength, and precision operation spell out the reasons for the use of Lear electro-mechanical products on almost every commercial and military aircraft flying today. Let us discuss *your* electro-mechanical problems. We will either have the answers on hand or be able to develop them quickly.

LEAR MODEL 550 SCREWJACK *(shown above)*
Combines with three similar units to complete a positive, non-reversing engine cowl flap control system for the Convair 340. The entire assembly is actuated by a common power source through a Lear system of flexible shafting, which can be utilized to transmit power to additional accessories.

EM-4

LEAR INC. GRAND RAPIDS DIVISION
110 IONIA AVE., N. W., GRAND RAPIDS 2, MICHIGAN
Executive Offices: 3171 S. Bundy Dr., Los Angeles 34, Calif.

NEW miniature damped control motor type 17 ID....



...for servo and instrument applications

SERVOMECHANISMS, Inc. Type 17ID2-8 is a balanced 2-phase, 26 volt, 5500-RPM, 400 cycle damped induction motor employing a drag cup and an axially adjustable magnet to achieve velocity damping. This design provides for variable and smooth linear velocity damping and lower operating temperature. The desired degree of viscous damping is achieved by operating setscrew adjustment.

* * *

The non-damped induction control motor 17I2-8 of 8,000 RPM is also available.

FEATURES OF DAMPED CONSTRUCTION DESIGN INCLUDE

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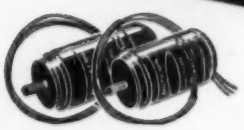
- Constant Damping
- Lower Inertia
- Lower Cost

Write to Dept.- 10-SM-5 for specific information on motors.



OTHER INSTRUMENT MOTORS

..... Hysteresis Synchronous design, Type 17HI-8 for 26 volts and Type 19H for 115 volts in speeds of 8,000, 12,000, and 24,000 RPM are available for various applications. Special windings and external shaft configuration can be provided on request.

SERVOmechaNISMS INC.
WESTBURY, L. I., N. Y.
EL SEGUNDO, CAL. NEW CASSEL, N.Y.

(VCO) pressure which, in turn, determines the main fuel pressure by means of the fuel bypass valve. This valve bypasses a part of the fuel discharge from the constant-displacement main fuel pump.

VCO pressure operates the bypass valve—an increase in VCO pressure increases the fuel pressure to the nozzles by reducing the bypass flow. Similarly, a decrease in VCO pressure decreases the fuel pressure to the nozzles by increasing the bypass flow. VCO pressure from the regulator is dependent upon the setting of the pilot's throttle, altitude conditions, airspeed, and the operating limits of the powerplant, Small says.

Bypass fuel is carried back to the fuel pump inlet. Remaining fuel at engine pressure passes through a manually operated stopcock, through the oil cooler and into the flow divider. The divider separates the fuel, part of it going into the small-slot manifold and the remainder to the large-slot manifold.

Fuel is then fed to the combustion chamber fuel nozzles, with the small slot for low fuel flow and the large slot acting in parallel for high flow. The large-slot manifold is not operative until the fuel pressure in the flow divider reaches a certain value, Small reveals.

▶ **Emergency Fuel**—The single-engine-fighter version of the J47 is equipped with an emergency fuel system, Small reveals.

This arrangement has an emergency fuel regulator and a check-and-restrictor valve in addition to the components of the main system. The dual-element fuel pump supplies both the main and the emergency systems at two discharge ports, one feeding to each system.

The flow supplying the emergency system is split, part going to the check-and-restrictor valve and then to the main fuel check valve, the remainder going to the emergency fuel regulator which bypasses it back to the fuel pump inlet.

Small says that fuel from the emergency system is prevented from entering the main fuel check valve because of the pressure differential across the valve when the main system is supplying the engine.

▶ **In Case of Emergency**—The emergency system will take over control of the engine whenever the main system pressure drops below that set by the emergency system. Fuel flows through the emergency check and restrictor valve to the nozzles through the main system components. But, the amount of fuel flow is determined by the pressure established at the emergency fuel regulator. This, in turn, is controlled by the throttle position and the compressor inlet air pressure.

Maximum fuel flow is slightly lower

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Turbine powered auxiliary power unit is shown. Western Gear has designed and built many gear drives for use with gas turbines.

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Power-On Scale Model . . . illustrated is a Western Gear designed and built scale model of counter rotation unit for power-on wind tunnel testing.

Illustrated is a Western Gear main power drive for a wind tunnel. Many standard and special gear drives are available for laboratory, research and other aviation industry experimental projects.

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during emergency system operation, than it is on the main system, because on standby operation the emergency system pressure is set lower than the main system pressure to prevent "overriding."

Icing Prevention

The J47 "E" series engines are anti-iced for all-weather operation.

The frontal area of the engine exposed to the inlet air stream requires icing protection, and the parts involved include the island fairings front frame struts and inlet guide vanes.

The bullet nose, installed by the airframe manufacturer, also requires anti-icing air from the engine. The air screens need no anti-icing because they are retracted in flight.

▶ **Hot Air Source**—Small says that compressor discharge air is taken off a pad on the rear frame, brought forward into a manifold and through island No. 3 into the bullet nose. The manifold also ducts the hot air to the four-island fairings. Air fed into a cavity at the leading edge of the fairings is discharged into the engine air stream through vents on the fairing sides. The pilot controls the flow of this anti-icing air.

The inlet guide vanes and front frame struts are anti-iced continuously with 12th-stage air bled at two points 180 deg. apart on the compressor casing. Guide vane anti-icing air is brought through two elbows into a manifold discharging into the balance piston area.

▶ **Vents and Drains**—To dispose of any fuel or oil leakage from accessories during operation and from the combustion system after engine shutdown, a vent and drain system is installed.

There is also a vent system to maintain proper pressures on the three air-oil seals in the engine. The No. 1 bearing air-oil seal is vented through the compressor front frame to the external cooling air flowing past the engine. The No. 2 bearing seal is vented through two ports in the rear of the compressor rear frame. The No. 4 bearing is vented in a similar fashion, with the air and oil vapor being piped from the seal to the rear of the turbine frame housing and from there into the cooling air stream.

The No. 2 and 4 bearing seals, along with the turbine frame housing, form a closed space containing lube oil vapor and air. This region is provided with a vent—the turbine frame oil breather—to create a slight negative pressure differential across it.—IS

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"FEEL"
back in the
WHEEL
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Resin-Glass Tank Is Shatterproof

A light, shatterproof, reinforced-plastic air-storage tank is featured in a new jet engine starter system now in production at the Utica division of Bendix Aviation Corp., Utica, N. Y.

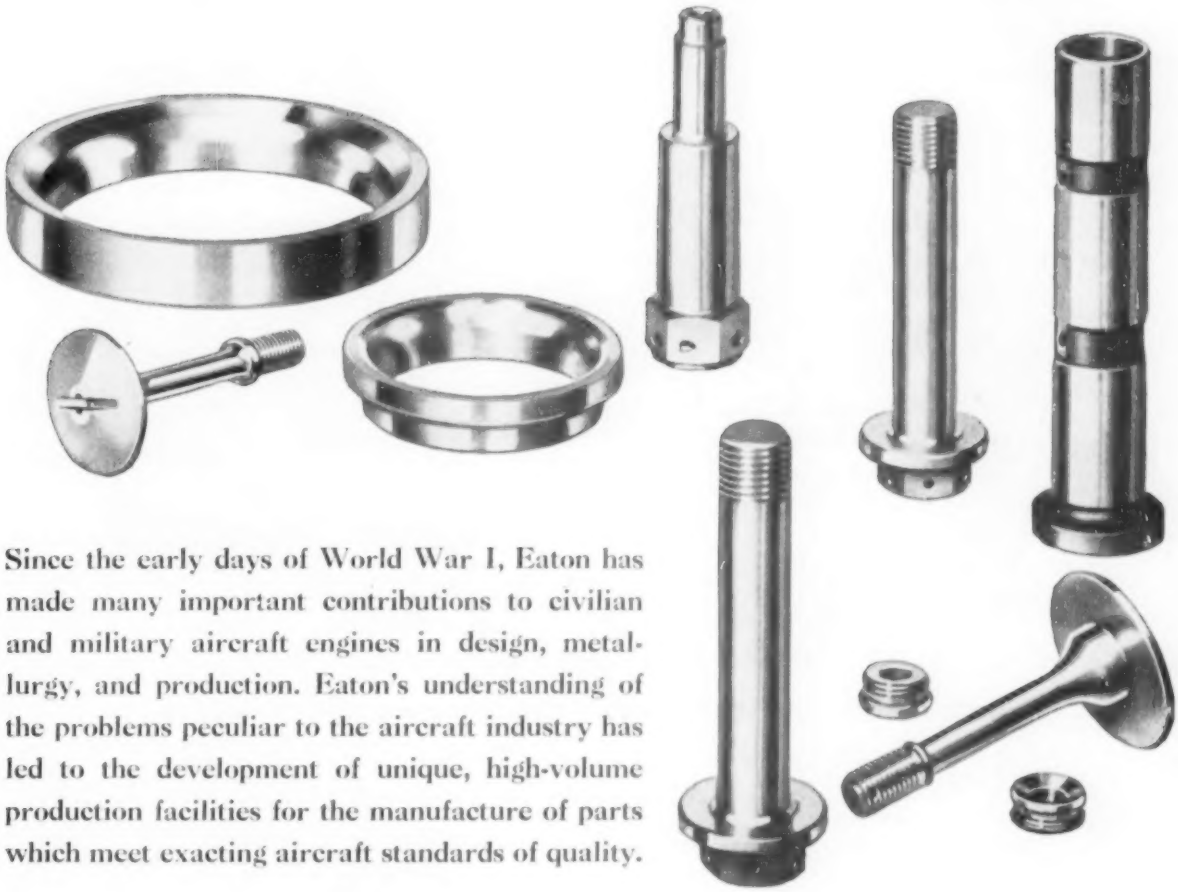
The starter system with its plastic tank has been installed on a Republic Aviation Corp. F-84F Thunderstreak for performance checks in energizing the Wright J65 turbojet. Reports are that the trials have been successful and that the system will be installed on future Thunderstreaks.

▶ **How Used**—The plastic tank—a Fiberglas-Epon resin combination built as a 13-in.-diameter sphere with walls ¾ in. thick—is used in fuel-air combustion starter system as an air reservoir

TANK is made by winding resin-impregnated glass thread around low-melting alloy.

Aircraft Parts by Eaton

combine outstanding developments in design, metallurgy, and production engineering



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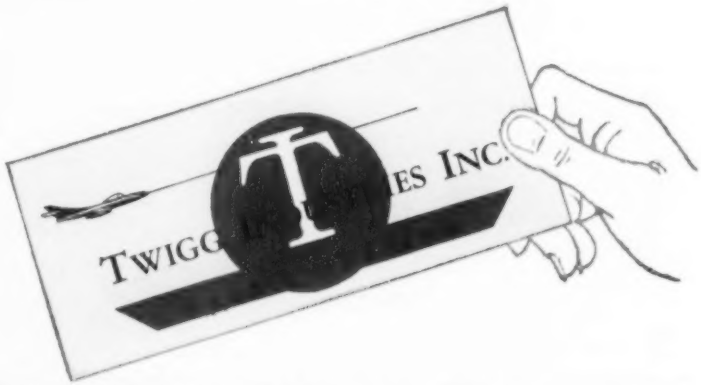

combustion chambers • transition liners • turbine casings • tail cones • burner supports • brackets • all type spinnings • tube bending • other essential components

fed by an airborne compressor.

It stores and supplies air to mix with the jet engine fuel for a combustible charge to drive a turbine geared to main engine compressor rotor; this cranks it up for engine starting. The reservoir is recharged by the airborne compressor during flight. Volume of the tank is 900 cu. in.—enough for two starts without recharging.

▶ **Light**—Developed jointly by Bendix Aviation, Teterboro, N. J., and Apex Electric Mfg. Co., Cleveland, Ohio, the plastic reservoir is made by Apex and sold by Bendix.

It has a container-to-air weight ratio of about 2:1 as compared with 3:1 for a comparable steel unit. The plastic reservoir weighs 16 lb. empty and holds 8 lb. of air at 3,000 psi. for a total charged weight of 24 lb. The steel tank empty would weigh about 25 lb.

▶ **Strong**—The shatterproof characteristics of the charged reservoir give it a big safety factor in resistance to gun blast effects.

Burst strength of the unit is 7,000 psi. It has passed cycling tests by going to 26,000 cycles without failure. Acceptance tests require 10,000 full pressure cycles—from zero to 3,000 psi. and back to zero at 30-sec. intervals without failure.

▶ **Other Uses Seen**—Bendix engineers see no reason why the plastic reservoir could not be used in other high-pressure pneumatic applications, such as for bomb-bay door actuation, nose wheel actuation or gun-charging installations. Use as a gas storage vessel in missile applications is another possibility.

Actually, requests have been made for information on different size tanks for special purpose applications.

▶ **How Made**—The reservoir is manufactured by winding a continuous roving or thread of Owens-Corning Fiberglas impregnated with Shell Chemical's Epon resin onto a mold made of a low-melting-point alloy. The aluminum alloy air inlet and outlet connections are cast into the mold. The mandrel on which the mold revolves during the winding process is screwed into the tapped hole in the air connection (which later accepts the control valve).

The material is cured at 240F for 2 hr., after which the mold material is melted out and reused.

To Process Missile Data

Land-Air, Inc., Chicago, Ill., has received a contract from Navy for processing and analysis of technical data at the Navy's Guided Missile Test Center, Pt. Mugu, Calif. The firm's operation at the test center will be coordinated with and assisted by its Data Reduction Service in Los Angeles.

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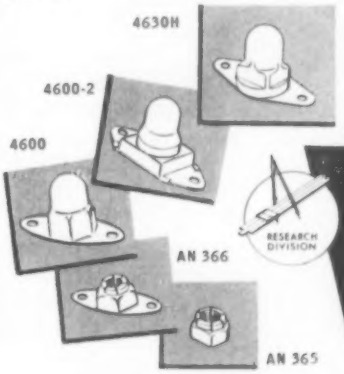

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An American at Farnborough

Notes and Photos on SBAC Exhibition

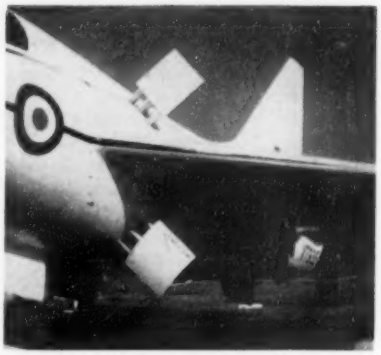
London—Society of British Aircraft Constructors' Farnborough display is a double-barreled affair; it combines some of the world's best flying with some of the world's best design ideas.

The flying is spectacular, noisy and gaudy.

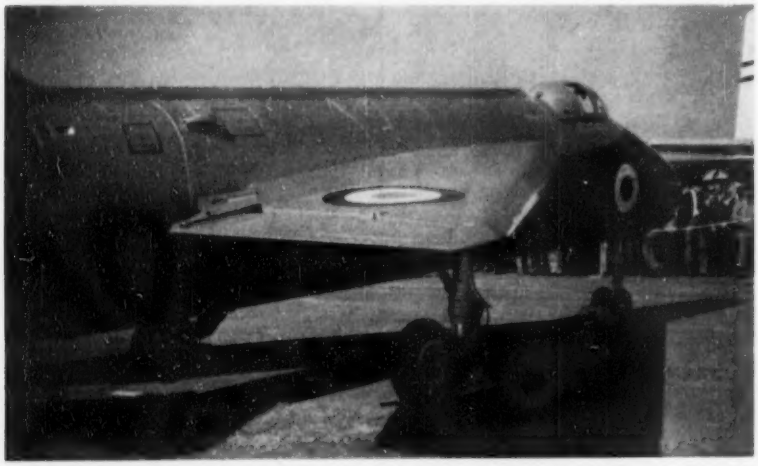
The design ideas are serious, understated and sometimes nearly hidden on airplanes in the static park, or on the stands under the beige canvas canopy of the exhibition tent.

Both sides have to be seen before you can hope to understand and evaluate the direction of British aviation progress. The two sides—while distinct—are often so intertwined it is difficult to separate them:

- Flying engine testbeds and aerodynamic modifications point up the lack of altitude test facilities and wind-tunnels.
- Unexplained holes in the Javelin's wing may suggest new armament.
- The Swift demonstrates dive brakes and the Hunter doesn't.
- Handley Page and Percival show bright dreams in models of DC-3 replacements.
- Saunders Roe has glistening white

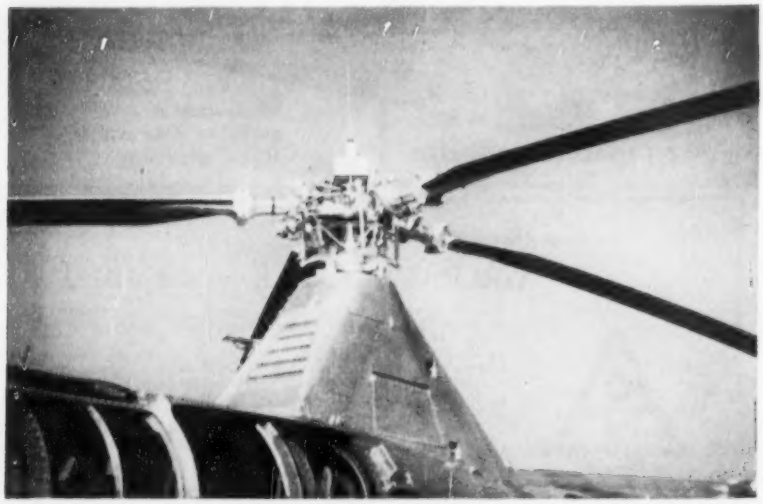


PETAL BRAKES on Boulton Paul P.111A delta-winged research craft are only difference between it and predecessor P.111. Bright yellow plane, fastest delta at show, is effectively slowed by these brakes.



DROOP SNOOT of Short Bros. & Harland S.B.5 adjustable-sweep research craft is built-in to wing airfoil contour. Wing is adjustable on ground only to a maximum angle of 59 degrees. Landing gear is non-retractible, must be repositioned for each angle of wing sweep to compensate for CG position.

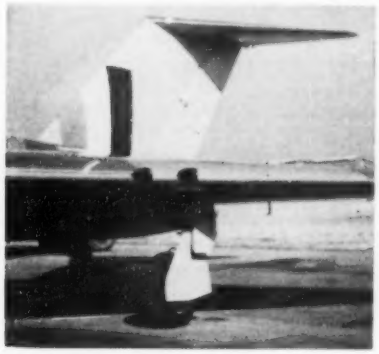
SEA MEW tail structure shows simplified design approach characterizing this "stripped-down" anti-submarine craft by Short Bros. Tailplane has constant chord; corrugations of rudder eliminate internal structure.



FOUR-BLADED ROTOR is modification made by Westland Aircraft on Sikorsky S-51 built under license. Blades are all-metal and are being tested to improve speed performance of the copter, and for possible application to more advanced designs. Craft serves with RAF and Navy.

BEAVER TAIL is new on Mk. 2 de Havilland Canada light bush transport and army liaison craft. Corrugated structure is cheap, simple and rugged.

By David A. Anderton

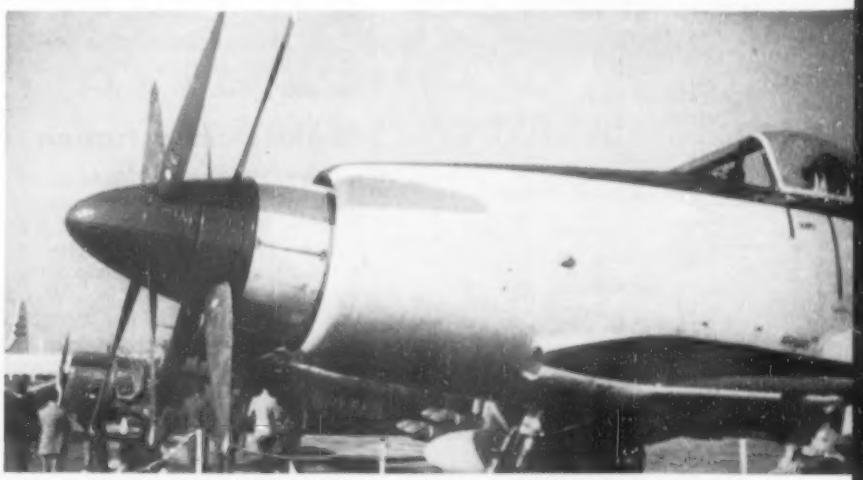


WING PORTS in Gloster Javelin have been variously reported for 30-mm. cannon or rockets. Diameter of holes—about four inches—lack of blast tubes and spanwise location point toward use of rockets.

TRIANGLE TAIL of Short S. B.5 perches atop vertical surface for Farnborough flights, will be lowered below fuselage for future tests. Tail is adjustable-incidence type. Anti-spin and brake chutes are used.

EXTRA FIN area is provided on production Westland Wyverns by hexagonal surfaces outboard on stabilizer. Layout is similar to that of Fairey Gannet.

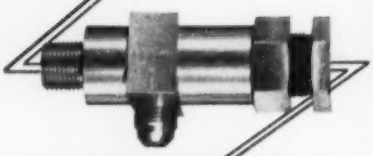
COCKPIT CLOSEUP of de Havilland 110 shows difference between pilot's position on left side of elliptical fuselage and that of radarman on right side under hatch. Nose radome and structure conceal half-ton of radar and armament. Production version will have single tail and engine.



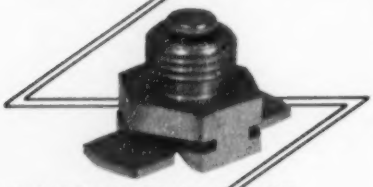
PROBOSCIS of Westland Wyvern T.4 turboprop strike fighter for Royal Navy shows neat cowling job over Armstrong Siddeley Python engine. Production Wyverns are just getting into squadron service after almost five years of continued teething troubles, centered mostly around the powerplant.

NEW NACELLES for Proteus 705 engines in Bristol Britannia turboprop airliner increase effective jet thrust, further reduce already-low noise level in cabin. Earlier installation led exhaust out of top of nacelles, turned gases through about 60 degrees. Plane is in production for BOAC.

ALLEN AIRCRAFT for reliability

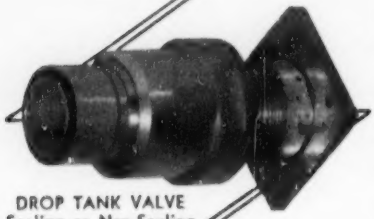


PRESSURE RELIEF VALVE
Metal to Metal Seal



SELF-LOCKING DRAIN VALVE
Straight or Pipe Threads

CHECK VALVE
Poppet Type



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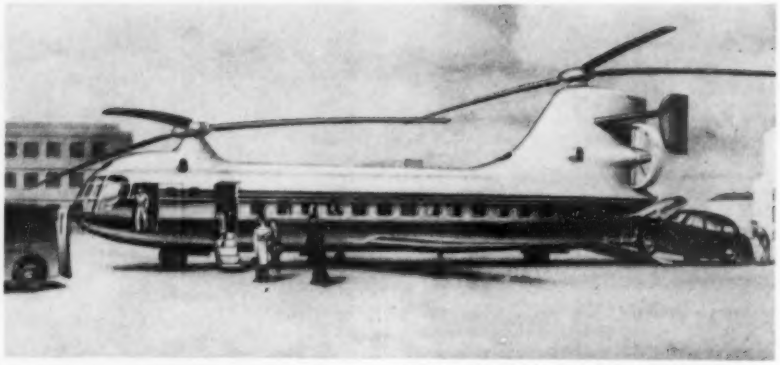

SAUNDERS-ROE copter, to meet BEA spec for 40-seater, uses ducted fan for propulsion, low wing to unload rotor in forward flight.

models of flying boats—the official lost cause in British aviation—and flies the graceful Princess over, gorgeous in gray and white with gold trim.

The photographs on these pages are an American observer's "notebook" on this year's Farnborough show.

Flight Demonstration

The amplifier system blasts out greetings, announces the scratches—**no** Princess, **no** Gannet, **no** Comet 2—and explains the new rules for safety.

▶ **The Flypast**—The first group of planes gets off. Led by the Westland Wyvern, first shown in 1949 and just now getting into squadron service, they fly past. The big Avro Shackleton, a four-engined Coastal Command maritime reconnaissance plane, sails by on a single inboard engine.

Helicopters—Westland-Sikorsky, Saro Skeeter, and Bristol 171 and 173—perform. On takeoff, the 173—equipped with stub wings and fins—slows perceptibly and eases into the air; the announcer says that apparently the pilot had decided to demonstrate single-engine takeoff.

Two Canberras whistle for takeoff, and leap from locked brakes like boosted missiles. Bristol Olympus engines thrust one up at a steep climb; the one following roars up like a rocket on the tremendous power of a pair of Rolls-Royce R.A.14 Avons.

A bright red Auster Aiglet, Ranald Porteus up, shows that all the flying isn't highspeed. Porteus, probably the best aerobatic pilot at the display, keeps his Aiglet over the runway in a series of maneuvers that words are pale to describe. But they include inverted snap rolls near the top of a zoom, stall turns in the same location, one-wheel "skating" landings.

▶ **Individual Demonstrations** — Then comes a welter of individual demonstrations by large and small, fast and slow, military and civil.

Impressions: The howling whine of the Gloster Javelin, with modified air intakes this year; it looks slow for some reason. . . . Boulton Paul's bright yellow P.111A delta is fast and quiet; petal dive brakes really work. . . .

Blackburn Beverley freighter demonstrates abnormally short landing run after big buildup by announcer during takeoff. It grinds to a halt, reverses all props, backs up, cuts power on one side, pirouettes in a 360-degree turn on the runway and then trundles off. But it took yards of runway to get airborne. . . .

Vickers' Swift takes off fast and flat, snapping wheels up and closing doors in fractions of a second. . . . Avro's six deltas fly by and wind up the demonstrations.

Static Displays

▶ **Saro Copter Coach**—Saunders-Roe featured a model of a proposal for the BEA coach helicopter. Designed as a 40-50 seater, the Saro craft uses a tandem rotor layout for vertical lift, and a high-aspect-ratio wing to unload the rotor system for forward flight. Propulsion is provided by a ducted fan installation mounted at the rear of the fuselage.

Saro took over the contracts of the Cierva Co. in 1950, and has since done considerable experimental work in the rotary-wing field with the little Skeeter and the big Air Horse.

▶ **Percival P.87**—This DC-3 replacement, one of five currently being designed or built in Britain, was shown in model form. It is an exceptionally clean aerodynamic design, with high-aspect-ratio wing and pusher turboprops. Powerplants are unspecified Napier engines, which might be the Elands.

Gross weight is about 26,000 lb., passenger capacity is 36 with seats at a 34-in. pitch. Most economical stage length has been estimated at 300 nautical miles, and the corresponding cost is about 2.2 cents/pass. nmi.

An amusing sidelight was the off-again, on-again appearance of a model of the Percival P.74 pressure-jet copter. The Ministry of Supply security officers

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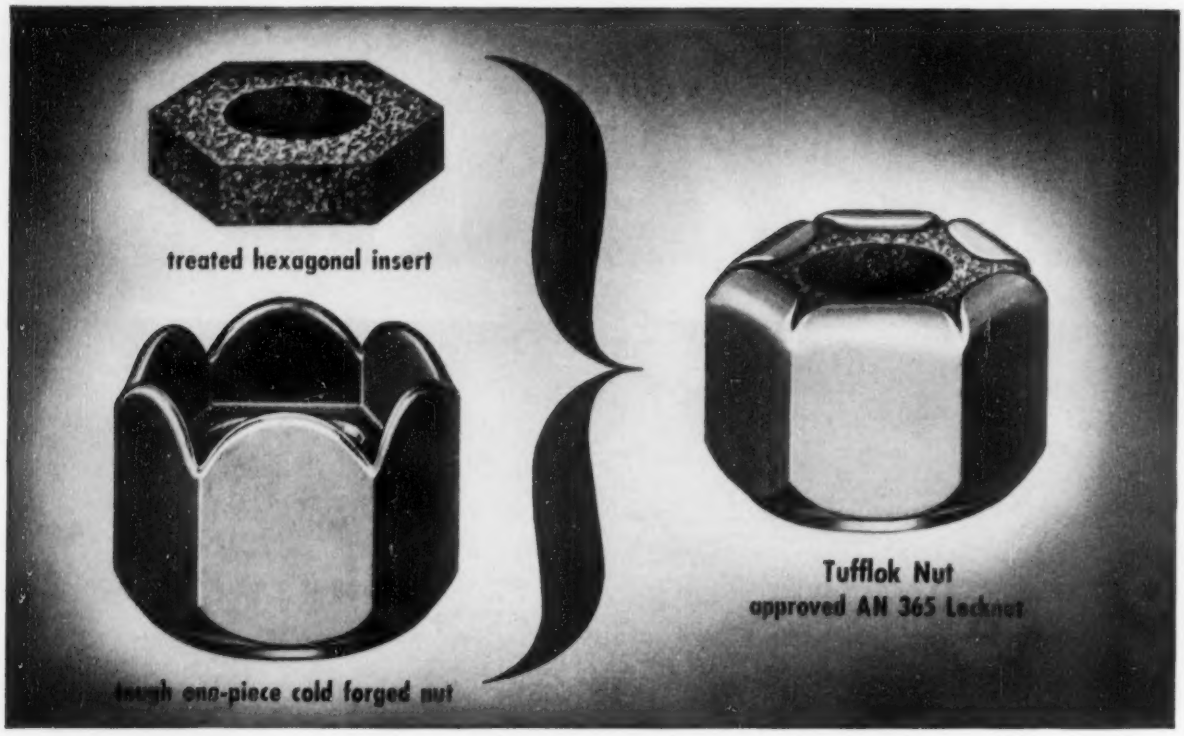

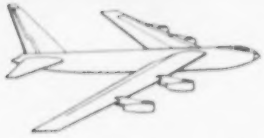

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In Canada: *Parmenter & Bulloch Manufacturing Company, Ltd., Gananoque, Ontario.*

TEST VEHICLE for missile development is this early Armstrong Whitworth job. Booster cluster is unique approach, differs from tandem installation favored in U. S.

removed the model from display after the first day, and then let it go back on again at the end of the show. Built around a Napier low-pressure system (presumably from a gas generator unit based on the compressor section of the Eland), this neat little copter is driven by tip propulsion through nozzles at the ends of its constant-chord blades.

▶**Guided Missiles**—Armstrong Whitworth showed a complete missile test vehicle which was probably about five years old. The body was the typical cone-cylinder combination now familiar in the missile field; surfaces were trapezoidal with double-wedge sections in a canard layout. Booster cluster was formed around the fuselage, instead of in the tandem arrangement favored in the U. S. Eight solid-fuel rockets were paired together; nozzles had angularity to divert thrust outboard for clean breakaway and a wedge-shaped solid nose was fitted to provide a radial force outward during booster separation.

Only other evidence of missile activity in the country was a model of a highly swept, Tee-tailed missile on the Fairey stand. It represented a project proposal that died on the drawing boards.

▶**Structural Idea**—A new approach to

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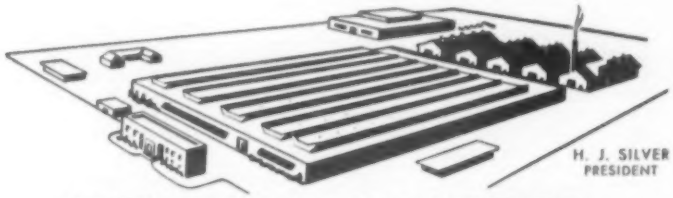

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(Advertisement)

Valve Talk

for WM. R. WHITTAKER CO., Ltd.

by Marvin Miles,
Senior Member, Aviation Writers Assn.

A B-47 Stratojet turns upwind at the head of the runway, a sleek and deadly arrowhead poised for a 4000-mile mission. She pauses for a moment in final run-up, then her six engines bellow as one and she rolls forward slowly at first, gathering speed second by second until her rushing weight is unshackled by the invisible lift of her wings and she soars aloft.

Her gear tucks up quickly and the doors slam closed. Soon she's but a climbing sun-glint in the distance, the lance point of a roiling smoke wake thinning outward to mark her course.

Aboard her are three men—pilot, co-pilot and navigator-bombardier—a trio of hand-picked, highly skilled, enthusiastic veterans entrusted with one of this nation's most potent bulwarks against aggression.

They're the brains, the heart, the courage of the B-47 in action. Without their dedication and their intelligence, the Stratojet would be useless. And it would be equally useless without the proper functioning of its many involuntary muscles, technical achievements in electronics, mechanics, hydraulics.

Take the B-47's valves, for instance, the small-to-large units buried throughout the airplane's structure, each carrying out its assigned role in the mission, each vital to the success of ship and crew.

Whittaker has 105 valves on the Stratojet—fuel valves of five different types, 14 types of hydraulic valves, two kinds of engine oil control units, and seven air valve types.

Many of these valves operate automatically and in sequence. The pilot never sees them, much less touches them. But he's always aware of them, nevertheless, perhaps subconsciously.

"It's like turning on a light in your home," a test pilot once told me. "When you hit the switch and the light goes on, you're hardly aware of it—and certainly you give no thought to why it functions or how. But if the light doesn't go on, you're conscious of it immediately."

Most vital of these five score and five Whittaker units are the fuel valves, of course, for on their proper cycling depends the life blood of the Stratojet's six jet engines—and very likely the lives of the three crewmen, particularly at takeoff when the heavily loaded medium is committed to full, continuous power.

Probably next in importance are the engine oil valves, providing lubricant in exact flow to power plants turning up 7000 r.p.m. Failure here would be almost as quick, equally as critical, as a malfunction in the fuel valve system.

Next come the hydraulic valves and air valves, each contributing to the efficiency of the Stratojet or to the comfort and safety of its crewmen.

In size, these Whittaker units range from shuttle valves that can be concealed in the palm of your hand to the intricate and highly developed 3½-inch motor-operated high temperature air valve. Their duties span from controlling canopy travel to raising and lowering the B-47's landing gear, from starting engines to nose wheel steering, from cabin heating and ventilating control to brake operation and hot air anti-icing and in-flight refueling. And in addition to the engine fuel and oil valves, there are Whittaker valves on the power plants themselves.

Almost all of these units are automatic, dutifully reporting their operation to the pilot by way of lights in the cockpit. Many function in sequence, depending one on the other to assure required flows and pressures and temperatures in stop-watch timing.

Most of them have been on the Stratojet from the beginning of this new Air Force era of high-speed, hard-hitting bombers . . . each valve designed by Whittaker to meet exacting Boeing specifications.

Many of us look at an airplane in terms of lines and power—and particularly performance. We see sleek contours and huge engines, flashing speed and climb, range and ceiling. And we overlook, completely, the thousands of less sensational achievements that combine deep within wings and fuselage to make the plane a success.

Yet each is vital in its own way, serving a special purpose to a special end. Nor could they be eliminated any more than the nerve system in your body, the valves in your heart.

With them you live. Without them you die.

So it is with the B-47—perhaps even the nation.

the problem of double-curvature skinning was presented by Aviation Traders (Engineering) Ltd.

Skin panels are cut to their flat-pattern shape, reinforced with edge stiffeners and then formed—in single curvature only—with short bulkhead sections. The panel then is placed on a plywood male jig and clamped at the larger end. Hand pressure will force the other end down to the point where it can be fastened in a clamp for final tightening.

Thus the double curvature is actually formed in the skin by tensioning after complete fabrication of the panel. Successive panels are edge-joined, and the jig pulled out to complete the fuselage.

Using this method, Aviation Traders have designed a DC-3 replacement called the Accountant. The fuselage, which is of the same general dimension as that of the DC-3, can be made in two days by five men, the firm says. They expect to be able to sell the Accountant—if it is produced—for about $224,000.

The prototype is expected to fly in about two years, if sufficient funds can be obtained. Aviation Traders has some of their own money in the project, but will need additional funding to carry it to completion.

▶ **Victor Tail**—The Handley Page stand showed a model of the Victor, giant crescent-wing bomber now in production.

Technical observers were quick to comment that the tail surfaces had been modified on the model. The "bullet" fairing at the juncture of the horizontal and vertical surfaces had been eliminated. Its job—to prevent breakaway at that intersection—is apparently to be done by a large-radius fillet on the underside.

The vertical fin has been modified to eliminate the dorsal area and the inlet for combustion heaters.

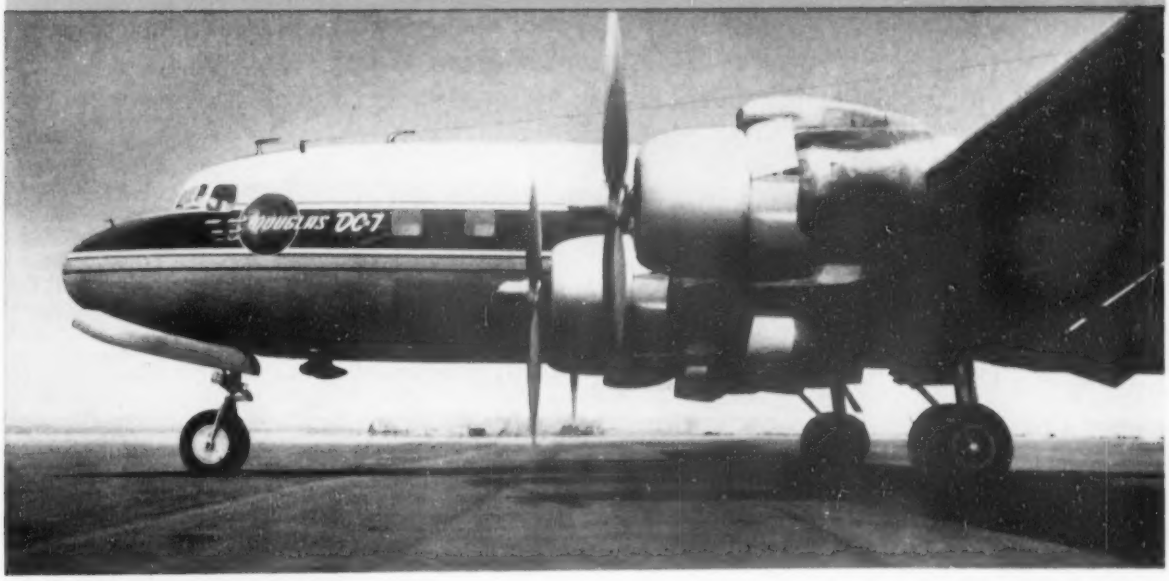
▶ **Gadgetry**—King Aircraft Corp. of Glasgow showed samples of its latest clamps, toggle latches and fuel fillers. These normally unglamorous, but necessary items, typified the ingenuity of gadget designers.

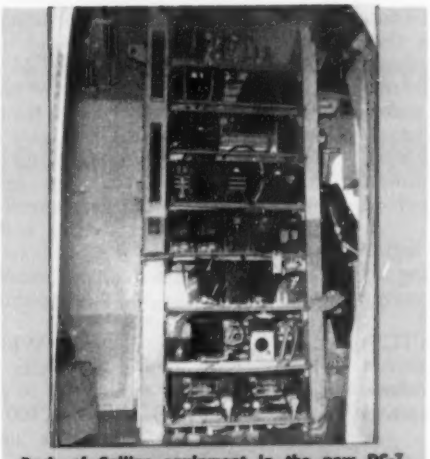
The fuel filler was a flush type, with a center handgrip between semi-circular plates. You grab the handgrip, and your fingers push down the surrounding plates against a spring compression spring. A quarter-turn unlocks the cap, which lifts clear.

King's flush latches for arctic use can be operated with a mittened hand. A red area marks the latch mechanism, and a push opens the toggle. Visual inspection tells whether the lock is closed or open.

King clamps work with a toggle action; once the adjusting screw is set, the clamp can be unlocked and locked by toggle action only. These clamps are in use on Avon tailpipes, for example.

What about this new DC-7?





Rack of Collins equipment in the new DC-7. Equipment that guides the big plane on cross country flying, leads it unerringly to precise instrument landings, provides dependable contact with ground stations at all times.

Sixty passengers can board the DC-7 and travel in air-conditioned comfort non-stop from coast to coast . . . in only 8 hours.

How fast is it? The fastest piston-powered airliner in the world. Cruising speed 365 mph. Top speed 400 mph. It takes you non-stop from New York to Los Angeles in just 8 hours. The power comes from four turbo-compound engines which generate a total of 13,000 horsepower.

What's it like inside? Luxurious and big. It seats 60 in air-conditioned comfort. With additional lounge space in the rear. The buffet can handle 72 complete meals and snack service. Cargo capacity: 13,980 lbs.

What kind of flight and radio equipment? Collins! Here's a typical installation of Collins equipment in the fabulous new DC-7: two 51V Glide Slope Receivers, two 51R-3 Navigation Receivers, one 351 VOR accessory unit and a 37J VOR antenna for dual ILS and Omni reception; the Collins 51R Receiver and 37R Antenna for VHF communications; the 18S Transceiver and 180 K Antenna Tuning Unit for HF communications; Omni Bearing Selectors for dual RMI instrumentation . . . all Collins.

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TRANS WORLD AIRLINES' N. R. Parmet rises to conduct discussion at Champion conference. Other airline chairmen (left to right): N. K. Davis, United; W. H. Wijnholds, KLM; R. W. Farren, Trans-Canada; J. M. Sorensen, Northwest; F. W. Lochner, Eastern.

Report on Sparkplug Meeting:

Experts Study Misfiring, Fouling

Champion conference reports results of TCP tests, reveals findings of ignition and engine analyzers.

By George L. Christian

Toledo—The latest advances in the field of aircraft ignition were examined by 140 experts gathered here recently at Champion's Aircraft Spark Plug and Ignition Conference.

While the subjects discussed were not in themselves new, fresh developments were aired concerning the anti-fouling additive, TCP (tricresyl phosphate), and spark plug fouling in general; engine and ignition analyzers; distributors and magnetos; and jet ignition.

The three-day meeting drew attendance from the U.S. and overseas—from airlines, from equipment and accessory manufacturers, from oil companies, from military and government groups.

▶ **TCP Today**—Tricresyl phosphate, Shell Oil's anti-plug-fouling additive for which very high hopes had been held out, has settled into its true perspective.

TCP is not a cure-all—Shell never said it was. It alleviates plug fouling under certain conditions, but in some instances has adverse effects on exhaust valves, corroding heads and cracking faces. Most helicopter operators, especially those flying the 200-hp. Bell 47-D1, find TCP essential to their operation. It is the only way they can keep plugs in the engines.

Here is a quick glance at the TCP picture as it now stands: No wide-scale airline tests are in progress or contemplated. American, KLM and TWA have discontinued their tests.

United is undertaking a limited test. TCP will be used at UAL's maintenance base in San Francisco in planes that make local test hops, etc. Wright also is starting tests with the product.

Shell says it has no immediate plans to market TCP aviation fuel in commercial quantities. On reason is that clogging of turbosupercharger nozzle boxes, experienced by Northwest Airlines on its Boeing Stratocruisers, makes TCP fuel unuseable in that installation. Shell says it will not consider marketing TCP fuel until it has been proven compatible with all known types of aircraft engine installations.

Airlines agree that TCP is highly effective in eliminating backfiring at takeoff, which can result in serious power loss.

TCP Talk—Other comments on TCP:

• **It does not adversely affect** aircraft combustion heaters, fuel tank sealants or carburetor diaphragms, the meeting was told.

• **Intermediate-type exhaust valves** are less vulnerable to TCP than inconel-type valves.

• **Backfiring at takeoff** has been reduced by 90% on DC-6s that use TCP, Scandinavian Airlines System reports.

• **TWA tried TCP on five** 049 Connies and operated five other 049s as control aircraft but found no significant difference in total spark plug removals. Maintenance records did show that the TCP aircraft had a lower plug removal rate but total number of removals was obscured by the plug fouling picture. Cylinder removals were 2½ times higher on TCP engines than on non-TCP engines.

• **Air Force cited** a quarter-million hours on R4360s in B-36s using TCP with an 80% reduction in plug fouling.

• **Pratt & Whitney** reported TCP has no detrimental effects on engine components exclusive of the exhaust system.

• **Rolls-Royce** found TCP was a complete cure for lead fouling, but cure was worse than the disease as far as the liquid-cooled Merlin engine is concerned.

R-R found that globules deposited on plug and caused pre-ignition, and exhaust valves were burned.

▶ **Why Misfires?**—Greatly expanded use of ignition and engine analyzers has revealed that, at takeoff powers, several spark plugs in an engine misfire. The phenomenon is not usually accompanied by noticeable loss of power and generally ceases immediately at the first power reduction. This phenomenon is not to be confused with backfiring at takeoff, which does result in power loss.

To quote R. K. Christie, Champion's chief engineer: "A new hypothesis has been evolved which demonstrates that what has until recently been considered a fouled plug pattern is now recognized as a misfiring pattern which may or may not initiate combustion.

"The current discharge in a misfiring plug does not occur between the electrodes of the spark plug. Rather, it follows a path along contamination on the nose ceramic to ground."

Spokesmen at the meeting said that this misfiring does not occur on brand-new plugs, presumably because the nose ceramic of new plugs is free from contamination. But they pointed out that new plugs are no guarantee against misfiring even on the first takeoff.

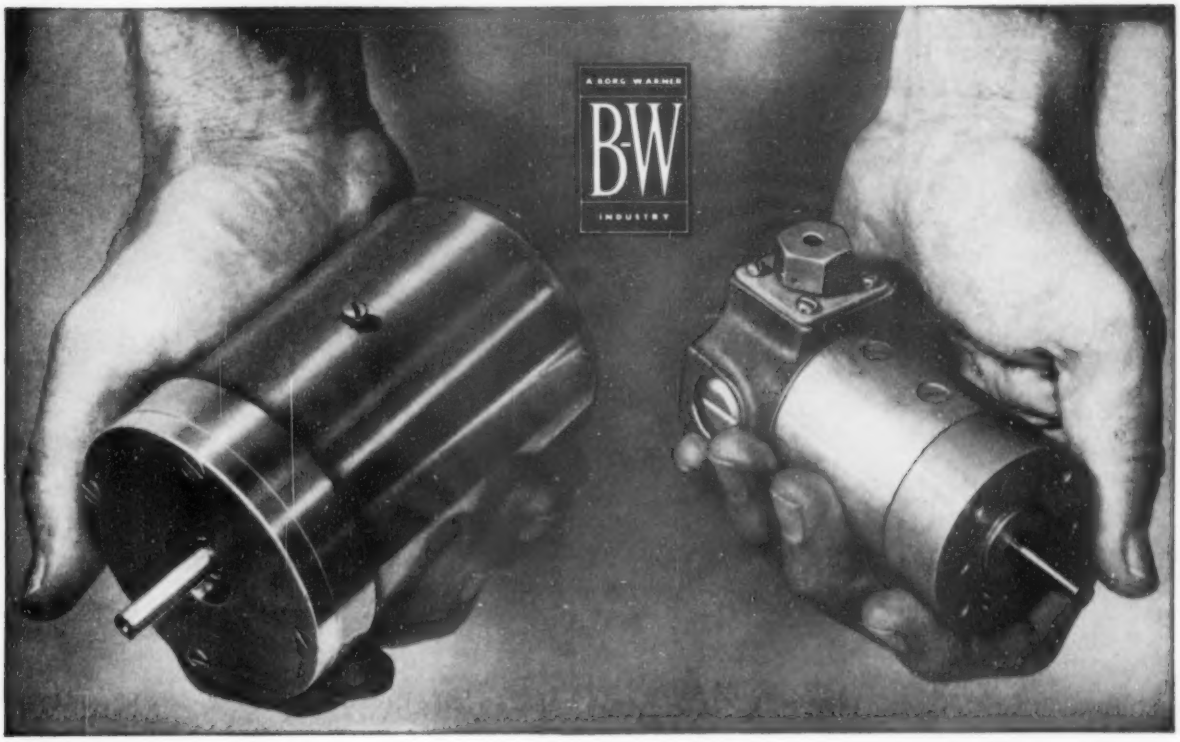
In the brief time it takes a plane to start its engines and taxi to the takeoff runway, sufficient contamination can accumulate on the nose ceramic to precipitate misfiring.

Al Yacavone of Pratt & Whitney Aircraft stated that during tests conducted at P&WA, as many as 26 plugs out of a total of 36 in an R2800 had been observed to "blink" or misfire during a single full-power run.

But even with that many plugs misfiring, no power loss was visible on standard engine instruments such as the BMEP gauge. Dynamometer tests showed that horsepower losses under conditions of multiple misfiring were as low as 25 hp. for the R2800.

▶ **Analyzers**—Most major airlines at the meeting either had bought analyzers or were committed to. Trans World Airlines said it was still on the fence.

Philippine Air Lines reported it was using vibration pickups in its test cells to check newly overhauled engines. John Kinkade of PAL spoke highly of the setup, claiming the pickups, installed on each cylinder, were particularly helpful in spotting improper valve



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For example—Pesco motors are now in use for: cooling (blowers for electronic equipment), tuning (radios and automatic finders), scanning antenna (civilian and military), antiaircraft radar fire control, as well as pump drives and mechanical actuators.

By using standardized parts in a series of six co-ordinated frame sizes, Pesco can provide you with electric motors for electronic applications with voltages from 6 to 120 volts D. C.; from 1/100 to 6 H. P. for operating speeds up to 15,000 R. P. M. Special, high-altitude design will operate from −65° to + 165° F.

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Motors in these frame sizes can be built for *your* specific frequency, using standard parts to obtain the speed and power rating desired. Consult our Engineering Department concerning your requirements. Strictest confidence—and no obligation, of course!

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PRODUCTS DIVISION

BORG-WARNER CORPORATION

24700 NORTH MILES ROAD • BEDFORD, OHIO

Back in 1927, Charles Lindbergh hopped the Atlantic—one way—in his "Spirit of St. Louis" plane, and furnished the news story of that decade.

During the past summer, Peter Gluckmann touched his tiny Luscombe down on California soil after spanning the American Continent and the Atlantic, not once but twice, and created scarcely a ripple outside his own home town.

The matter-of-fact acceptance of that round-trip trans-Atlantic flight, in a plane strictly stock except for wing tanks, speaks volumes for the strides made by aviation in the 26-year interval between the two events. With airplanes hopping oceans every day, neither Peter Gluckmann nor the public seems to have viewed his flight as other than routine.

Mr. Gluckmann undertook that flight entirely on his own initiative, asking no help from Continental Motors or anyone else. Nevertheless, as manufacturer of the C90 engine on which he staked his life, this company naturally finds intense satisfaction in its outcome . . . in the fact that Continental stamina, fine product of advanced engineering and strictest quality control, has again proved equal to a challenge far greater than could possibly be encountered in normal use.

Continental Motors Corporation
Aircraft Engine Division
MUSKEGON, MICHIGAN

action and floating valves before engines were placed in service.

National thinks Scintilla's load control is helpful in finding marginal plugs. Trans-Canada Airlines' Ray Farren agrees, provided load control system is properly understood and calibrated.

Operation of both Scintilla's ignition and Sperry's engine analyzers was praised.

National and Northwest like their instruments. Philippine said it could not maintain its tight schedules without its Sperry units. Capital said that its Sperry units, installed on Connies, saved two engines with cracked cylinders, so carrier feels that analyzers have already paid for themselves.

TCA, using the Scintilla unit on its magneto test stands, has turned back some 30 defective mags with zero hours on them. TCA's fleet wired for the analyzer.

Scintilla is investigating vibration pickup, but believes that there is considerable question whether vibration equipment is warranted. If it is, Scintilla can make units which can be used with present types of analyzers.

▶ **Plug Fouling**—Richard Teasel of Champion presented a new theory concerning the reasons for spark plug fouling. He suggested it was not absolute temperatures, but differential temperatures, which affect plug fouling rates. The greater the temperature spread between hottest temperature conditions (takeoff) and long-time temperature conditions (cruise), the greater the possibility of fouling, Teasel believes.

Champion's Christie stated that the electrical resistance of deposits is temperature-sensitive. He added that the type and quantity of deposit laid down on the nose of a plug are a function of heat of the nose (which varies from about 1,400 F on the tip to 950 F on the base).

The two basic types of spark plug fouling are carbon fouling, resulting from prolonged low-power operation on the ground, and lead fouling, which increases with plug operation.

▶ **UAL Study**—Some conclusions reached by United as a result of a study of unscheduled spark plug removals from R2800 engines used in DC-6s, -6Bs, and Convair 340s, were presented.

Using new and used plugs, UAL found that the optimum plug performance on the R2800 is 300-400 hr. Performance drops off rapidly in the 500-600-hr. bracket. UAL has had to back off from its goal of a 600-hr. overhaul period for the R2800.

Plug removal rate on the R4360 installed in the company's Boeing Stratocruisers is 650 hr. Boeing operators in general agreed that the engine is easy on plugs.

Rolls-Royce's Harold E. West noted

It takes a tough, heat-resistant bolt to withstand the temperatures of modern jet engines. Today, The H. M. Harper Company is manufacturing bolts, nuts, and other fastenings of the modern high temperature alloys such as Discaloy, Refractaloy, A-286, and special grades of stainless steel. If you require fastenings designed to withstand high temperatures, corrosion, excessive wear, or other extreme conditions, Harper engineers and metallurgists will gladly assist you.

For over a quarter of a century, The H. M. Harper Company has specialized in the manufacture of corrosion-resistant fastenings in brass, naval bronze, silicon bronze, monel, aluminum, and all stainless steels, and is today America's largest producer of such fastenings.

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Delta-C&S Air Lines

GENERAL OFFICES · MUNICIPAL AIRPORT · ATLANTA, GEORGIA

August 24, 1953

Vickers Incorporated
1400 Oakman Boulevard
Detroit 32, Michigan

Attention: Mr. F. T. Harrington, Vice President

Dear Mr. Harrington:

It was interesting to note that both Delta and C & S while still separate companies had specified Vickers pumps, motors, motorpumps, accumulators, valves etc., for the hydraulic systems of new Convair 340 aircraft. Vickers hydraulic accessories were already in service on the DC-6s and Constellations. This simplified integration of our flight equipment at the time of the merger.

Working separately, Delta and C & S arrived at the same reasons for specifying Vickers Hydraulic Accessories. We wanted accessories which would have outstanding reliability, high overhaul periods, low overhaul costs, interchangeability between aircraft and minimum parts stock requirements. We also wanted the attention of service personnel when necessary, ready parts availability for normal overhaul and repairs plus indications of continuing product improvement. As a merged company (the fifth largest U.S. Airline), we still feel that Vickers and their Hydraulic Accessories meet our requirements.

We thought you would like to know that Vickers accessories have also been specified for our new DC-7 aircraft. We are sure your company will continue to provide the effort and attention necessary to maintain the position you now enjoy with us.

Very truly yours,

DELTA-C&S AIR LINES

C. H. Dolson
Vice President, Operations

that plug fouling is no problem on the Merlin engine provided the charge (final mixture) temperature is properly controlled to stay over 30 C. TCA keeps charge temperature at 40 C. Temperature control is automatic and cuts in only when charge temperatures drop below limits. This penalizes the engine only a few horsepower.

▶ **New vs. Used**—The debate as to whether it is worth the cost and effort to recondition plugs continued.

• **TCA:** "Reconditioning plugs cost is much as buying new ones. We use plugs once, salvage the platinum electrodes and chuck 'em away. Some 95% of plugs that were removed bomb tested O. K. . . . Bomb testing is valueless."

• **USAF:** "Each time we go to reconditioned plugs, unscheduled plug removal rates jump 100%."

• **TWA:** "At least 50% of the plugs removed because of malfunction are unwarranted removals."

• **Continental:** "We have no faith in the bomb tester. But all plugs removed because of poor Scintilla ignition analyzer readings are thrown out."

• **EAL:** "On R2000 engines (DC-4s), second-run plugs are as good as first-run units."

• **UAL:** "Only new plugs had been put in R2800 engines (DC-6s & -6Bs). There was no improvement in performance so we returned to using overhauled plugs."

▶ **Plug Cleaning**—Vapor Blast Manufacturing Co. is working on a plug cleaning machine which will cost about $1,000 and will clean two plugs at a time in 15-30 sec.

The machine will be available shortly after the first of the year.

The company says it may be used with caustic solutions since it provides ample protection to operator; built-in pump helps to keep abrasive in suspension without excessive compressed air consumption. The cleaning machine rotates plugs at 8 rpm. and cleans the electrode end of plug and the first couple of threads. It does not clean barrel end of plug, so a second operation is required.

USAF said clean spark plug barrels are of great importance, especially on high-altitude operations.

The three types of chemical cleaners —ammonium acetate, potassium hydroxide and sodium hydroxide—were criticized. Champion does not think ammonium acetate is effective and the two hydroxides have the disadvantage of being highly caustic.

KLM, which told last year's meeting it did not clean spark plugs but merely regapped them, this year admitted to sandblasting "very bad" plugs.

TCA spoke highly of a Lodge-developed ammonium acetate spark plug cleaner. This is the first, practical bulk cleaner—cleaning 36 plugs at once, the airline thinks. Method is to squirt heated chemical into plugs under pressure.

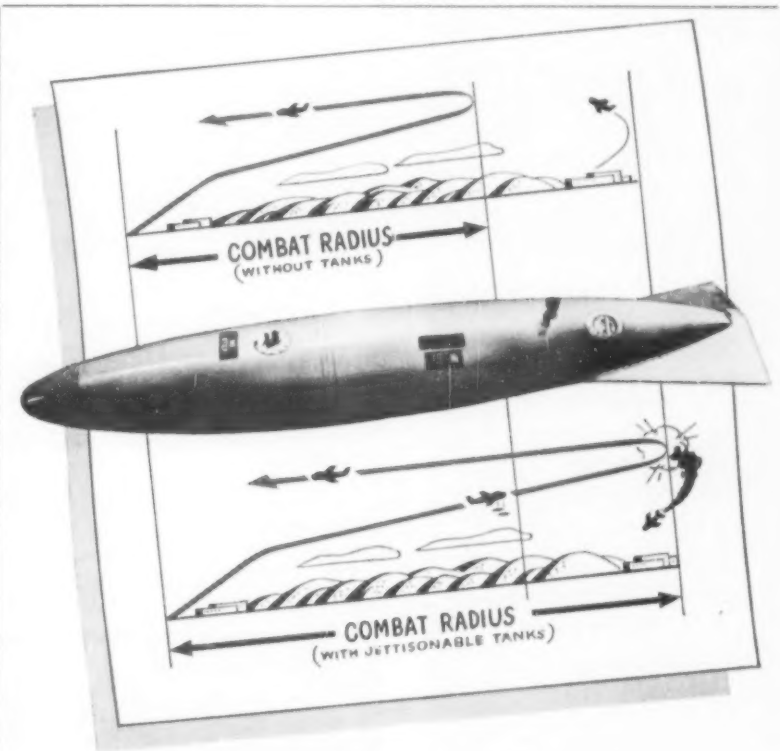
▶ **Plug Tester**—National Airlines' representative described an analyzer plug testing machine. He claimed the device, a home-made "Rube Goldberg," "duplicates spark plug operation in an engine fairly exactly," in spite of the fact that plugs are not heated.

Rig involves firing plugs while firing end is subjected to 100 psi. CO_2. Patterns are checked with an analyzer.

The machine does several things. It teaches crews what to look for in the way of spark plug patterns on the analyzer's scope. It fingers defective plugs after overhaul. And, as NAL put it: "The machine proved to our satisfaction that bomb testing of plugs doesn't test a thing. . . . Many plugs testing satisfactorily in the bomb test showed up as defective in the home-made rig. . . . And defective plugs turn up just as defective after overhaul; no improvement is noted."

▶ **Backfiring**—The meeting was warned of the hazard of excessive ground operation without periodically burning out plugs, especially when immediately followed by takeoff.

Philippine Air Lines noted that backfiring at takeoff occurs much more frequently at originating stations, where



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the aircraft stays on the ground for relatively long periods of time. En route stations, where planes' stay on the ground is relatively short, have considerably fewer cases of backfiring. PAL's statistics reveal that of 36 instances of backfiring, 28 occurred at originating stations, only 8 were noted at en route stops.

National's remedy for backfiring on its DC-6s and -6Bs is to burn out plugs (immediately after engine runup) by setting manifold pressure at 30 in. Hg or field barometric pressure, then gradually increase power takeoff setting. Although cylinder head temperatures have increased 10-15%, NAL says that backfiring has been reduced over 90%.

▶**Good Plug**—Paul Kovac of American Airlines praised Champion's ¾-in. –20 high-altitude spark plug. He said it functions very well and has practically licked the problem of barrel flashover.

Eastern's Ted Lochner said the plug, although labeled a high-altitude unit, functions well at all altitudes. The company is going to a fleet-wide conversion of the plug.

Wright Air Development Center eventually will be using the plug across the board. But program will be established on a replacement rather than a retrofit basis.

▶**The R111**—Champion's R111 plug has been approved by P&WA for all positions of the R2800 engine. This plug was released in August 1953 for service test.

TWA uses Champion's R37S-1 plug in all positions on its R2800s installed in its Martin 2-0-2s and 4-0-4s and finds them "eminently successful."

EAL tried 2,000 R27 plugs made by AC Sparkplug, but pulled the plugs because of electrode breakage trouble.

▶**Magnetoes & Distributors**—Magnetoes still are a source of trouble to the airlines but malfunctions are being systematically eliminated. This year's record was better than last year's.

Distributors are somewhat of an enigma. On the R2800, for instance, they give a considerable amount of trouble. Yet almost the identical unit on the R3350 gives a much better account of itself. Possible explanations are differences in temperatures between the two engines and variations in types of operations—altitudes, powers, etc.

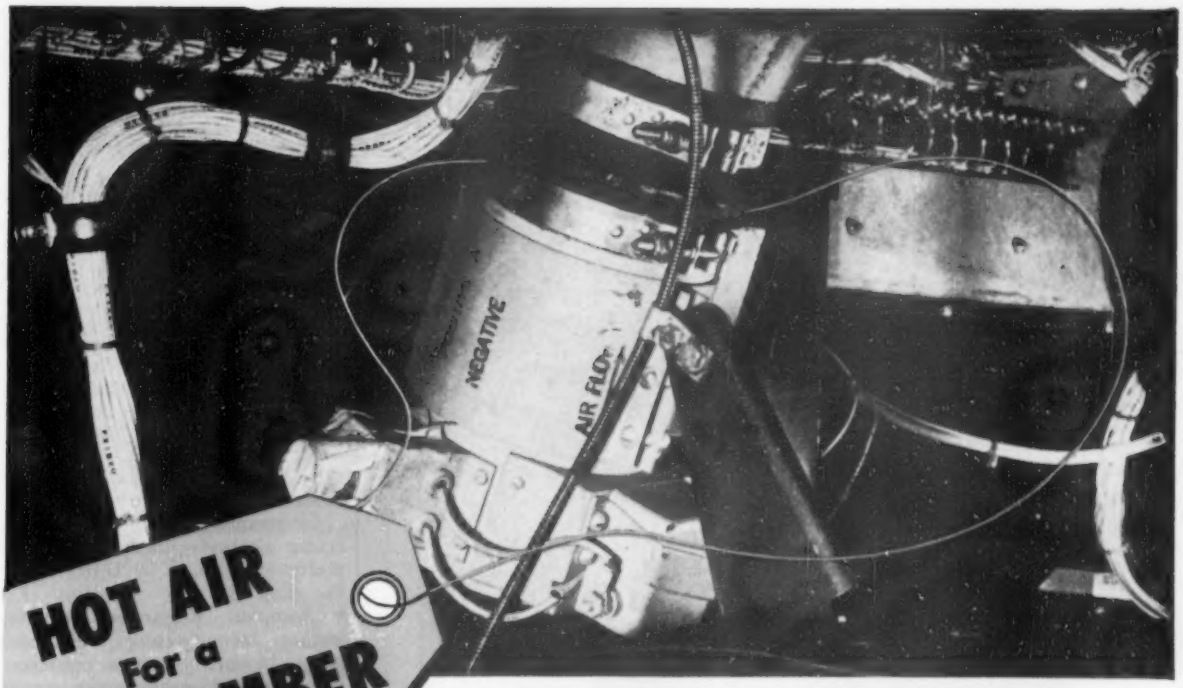
Pan American World Airways' representative had a suggestion to improve distributor performance: Redesign the unit to make brushes stationary and have a rotating commutator. This would allow the commutator to be machined to a true roundness. Scintilla said this could be done, but a host of new troubles might well emerge from the new design. The manufacturer volunteered to redesign the distributor finger if some airline would give a clue how to improve it.

▶**Jet Ignition**—Ignition system and jet engine manufacturers were in fairly unanimous agreement that high-energy, condenser-discharge-type ignition is a must for jet engine ignition. Electrode carboning is main jet igniter headache and the high-energy system completely eliminates this problem. Also, the system allows relights at high altitudes.

But there was disagreement about which type of condenser-discharge system was the best. General Electric spoke for triggered high-voltage (10-15-kv.) type in certain cases. Rolls-Royce favors the shunted surface gap low-voltage (1-2.5 kv) type, saying that

CANADAIR'S SCHOOL FOR T-33 TECHNICIANS

Canadair, at the request of the Royal Canadian Air Force, is running a school for RCAF service technicians in its new 170,000-sq. ft. hangar. Present instruction is on the Lockheed T-33 two-seat Shooting Stars. Similar courses are planned on the F-86 Sabrejet. Instructors, chosen from Canadair's technical staff, teach these subjects: airframe, engine, electrical, instrument, armament, communications and radar. Currently, the 4-week course falls into two parts. The first week, all students receive the same instruction so that each specialist knows something about the others' work. The last three weeks are given over to specialized instruction. To date, the school has graduated more than 250 technicians, some to become instructors in the RCAF. Canadair has also designed and built F-86 and T-33 mobile training units, incorporating some 17 different instruction panels, which have been sent to RCAF training schools. Later, these training units will take over all air force serviceman instruction.



HOT AIR For a HOT BOMBER from JOY AXIVANE AIRCRAFT FANS

The Boeing B-47 travels at altitudes where the temperature is somewhat less than balmy. Since the cabin is pressurized, the pilot wears no mask. Unless prevented, the moisture in his breath would quickly condense and freeze on the plexiglass windshield and canopy leaving him with no vision at all.

Boeing engineers installed a Joy AXIVANE aircraft fan, with integral heating unit, behind the instrument panel. Hot, dry air, blown through a Y-duct to both sides of the windshield, prevents frost at any altitude. It also eliminates the forming of windshield fog upon rapid descent into warm air.

This AXIVANE fan, standard on all B-47 bombers, is only 3½"" in diameter and 6¾" long, and weighs a scant 5 pounds, yet it produces 60 CFM at 5" W.G. Heater rating is 1500 watts at 27 volts. For safety, the heating element is thermostatically protected. A & N design specifications throughout.

● Joy designs and builds each fan to the exact requirements for which it is intended. Each fan, therefore, is custom-engineered for highest efficiency. For many purposes stock fans can be supplied from the extensive line already designed. Both single and two-stage units available. Optional features include straight or flared inlets, beaded or flanged connections, radio noise-filters, anodization, and cooled motors where required.

★ ★ ★ ★ ★

Here are some of the many uses for Joy AXIVANE Aircraft Fans: Windshield de-frosting, windshield or wing de-icing, cabin heating, cabin ventilating, cockpit heating, cooling radio and electronic equipment, cooling voltage regulators, oil cooling, gear-box cooling, instrument cooling, air recirculation, and high-altitude pressurizer boosting.

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this method gave less chance of flash-over at high altitude, for example.

Rolls-Royce's West recommended putting jet engine ignition boxes in the airframe somewhere to get it away from high heats. He added that in supersonic aircraft it did not matter much where you put it.

► **Plug Leakage**—Spark plug leakage and resultant ignition lead ballooning is still a problem. Wright Field found that pressure buildup in harness leads goes as high as 1,000 psi., so it is difficult for the lead to resist ballooning. Wright Field installed vents to allow pressure to escape.

Champion said that the glass seal "E" series R37S-1 plug greatly reduced number of leaking plugs and amount of leakage of any given plug. But the manufacturer warned that the "E" series is no guarantee against leakage.

Intergranular corrosion of spark plug center electrodes seems to have been pretty well licked by better firing of the glass seal.

► **Champion Research**—Champion is testing Inconel-center electrodes in plugs. Inconel has some promise, not being prone to intergranular corrosion. But its electrical corrosion is high. Company thinks that ground electrode problems may exceed center electrode problems in coming years. It has found temperatures as high as 1,340 F on ground electrodes.

Champion is interested in high-energy jet engine igniters and has some on test with major engine makers.

► **New Team**—Champion's Burns Maus kept the meeting moving, with a boost from R. L. (Doc) Anderson, formerly of Chicago & Southern Airlines, who now is Champion's service manager, and his three assistants, Harry Archer (formerly with National), Russell H. Biegel (formerly USAF), and Earl Koehler (formerly United Air Lines).

Coated Connectors Make Flexible Bends

Every bend in the 40 ft. of heater exhaust ducting in the Convair 340 is made flexible with glass cloth connectors coated with SE-101 silicone rubber.

The new SE-101, made from its parent material, SE-100 by the Silicone Products Dept. of General Electric, withstands temperatures of 600F, is crease- and abrasion-resistant, is unaffected by Skydrol hydraulic fluid and has unusual flame retardancy, its maker says. It can be ignited only with difficulty by an external flame and supports fire for only 6 sec. or less.

The product is also said to have good glass-to-glass bonding strength and fast-curing properties for mandrel-wrapped heater ducts.

NEW AVIATION PRODUCTS

Electronic Roughness Gage Requires Little Skill

A relatively inexpensive surface roughness gage capable of being operated by personnel without special knowledge or training is being manufactured and distributed by Brush Electronics Co., under license from General Motors Corp.

Named the Surfindicator, the gage has a range extending from 1 to 1,000 micro-inches average deviation from mean surface. A variable cutoff switch permits separation of waviness and roughness characteristics of surfaces by filtering out wavelengths exceeding .003, .010 or .030 in.

Precision reference specimens, complying with American Standards Assn. and Society of Automotive Engineers requirements, are supplied with the device to assure accuracy.

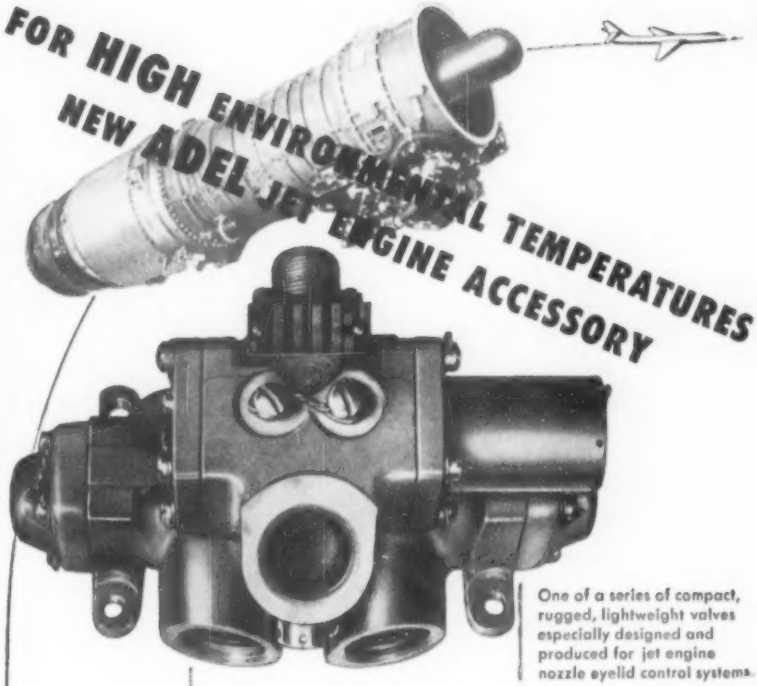
The Surfindicator employs a diamond-tip stylus which moves across the hills and valleys of the surface being measured. The microscopic mechanical motion is translated into electrical signals by a movable plate vacuum tube transducer. These signals are amplified and indicated on the meter as surface roughness in average micro-inches. The operator need only select the proper roughness and cutoff scales, guide the pickup over the work and read the meter, says the maker.

Price of the Surfindicater is given as $685. It weighs 15 lb. and occupies less than one-half cubic foot of space. The device is operated with 115-v. 60-cycle current.

Brush Electronics Co., 3405 Perkins Ave., Cleveland, Ohio.

Small Panel Indicator Gives Wide-Angle Light

Hetherington, Inc., has come up with a subminiature indicator or warning light weighing about ¼ oz. for stand-



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OPERATION

A Spring Offset, Two Position, Solenoid Operated, Four Way Valve using engine oil to operate hydraulic cylinders.

B Solenoid energized, 3000 psi at inlet port produces outflow at cylinder 1—cylinder 2 open to return.

C Solenoid de-energized, produces outflow at cylinder port 2, cylinder 1 open to return.

CHARACTERISTICS

1 Ambient temperature range −65° to +350°F.
2 Operating pressure 3000 psi.
3 Ports per AND10050 are available in 1/4", 5/16", 3/8", and 1/2" tube sizes.
4 No packing on sliding members.
5 Operating voltage 18-30 VDC.
6 Current required 1.0 amp. at 30 volts.
7 Continuous duty solenoid.
8 Pilot valve spring loaded against pressure to 4000 psi min.
9 Operating fluid MIL-L-7808.
10 None interflow type valve.
11 Weight 1.75 lbs.

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Continental AIR LINES

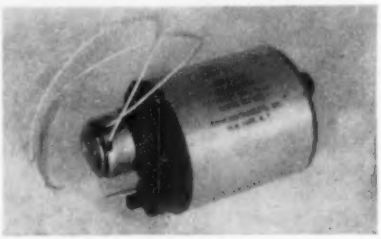
ard or edge-lighted panels.

Unit boasts wide-angle visibility with large area contact between base and lamp. Known as Series L 6000, it reportedly requires only ½ in. depth behind the instrument panel, not including contact.

A standard AN-3140 lamp is extended far into the plastic lens, with inside beveling of the plastic serving to throw light throughout lens to illuminate en tire periphery.

Lens measures 27/64 in. and is available in amber, blue, green, red or white.

Hetherington, Inc., Sharon Hill, Pa.



Units Measure Pressure, Acceleration Changes

Rahm Instruments, Inc., has recently completed design and development of a series of low-pressure, altitude, airspeed, acceleration and altitude-controlling potentiometer-type transducers.

• **Low pressure transducers,** known as the S series, include a number of instruments in the 0-5 to 0-30 psi, range for the measurement of gage, differential or absolute pressure. Rahm claims to have produced a small-size unit without sacrifice of resolution or linearity. Weight of all instruments in this series is 0.43 lb. Each measures 2 in. long by 2¼ in. in diameter.

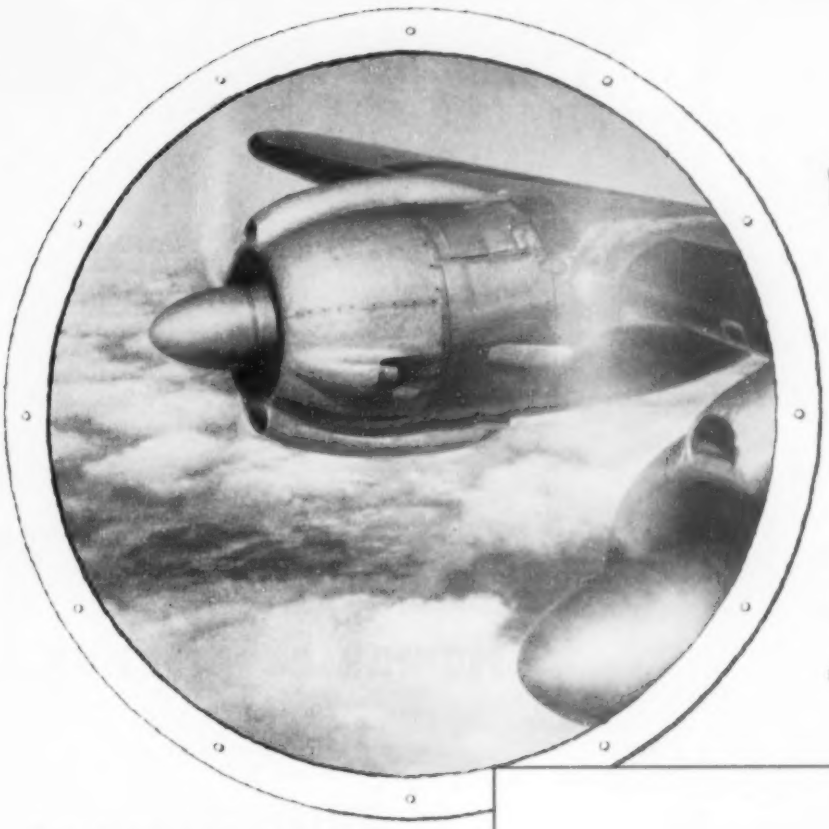
• **Altitude transducer** series covers ranges from 0-70,000 ft.; linearities of ±0.5% over full range are standard.

• **Airspeed transducer** series in the 50-700 mph. range exhibits ±0.75% linearity and 0.25% resolution over full range.

• **Linear acceleration transducers** are damped by encapsulated fluid system. In this series, special emphasis has been given a number of low-response instruments in the ±1G to ±5G range. Units range 1½ to 3 lb. in weight, measure 2.5 in. in diameter and between 3¼ to 3 lb. in weight, measure 2.5 in. in diameter and between 3¼ and 3½ in. in their length.

• **Altitude controller** operates this way: Equal pressure is maintained on either side of the diaphragm until a solenoid valve is closed, holding a fixed reference pressure on one side of diaphragm. Instrument then responds to and indicates differential changes from reference pressure.

Rahm Instruments, Inc., 12 West Broadway, New York 7, N. Y.



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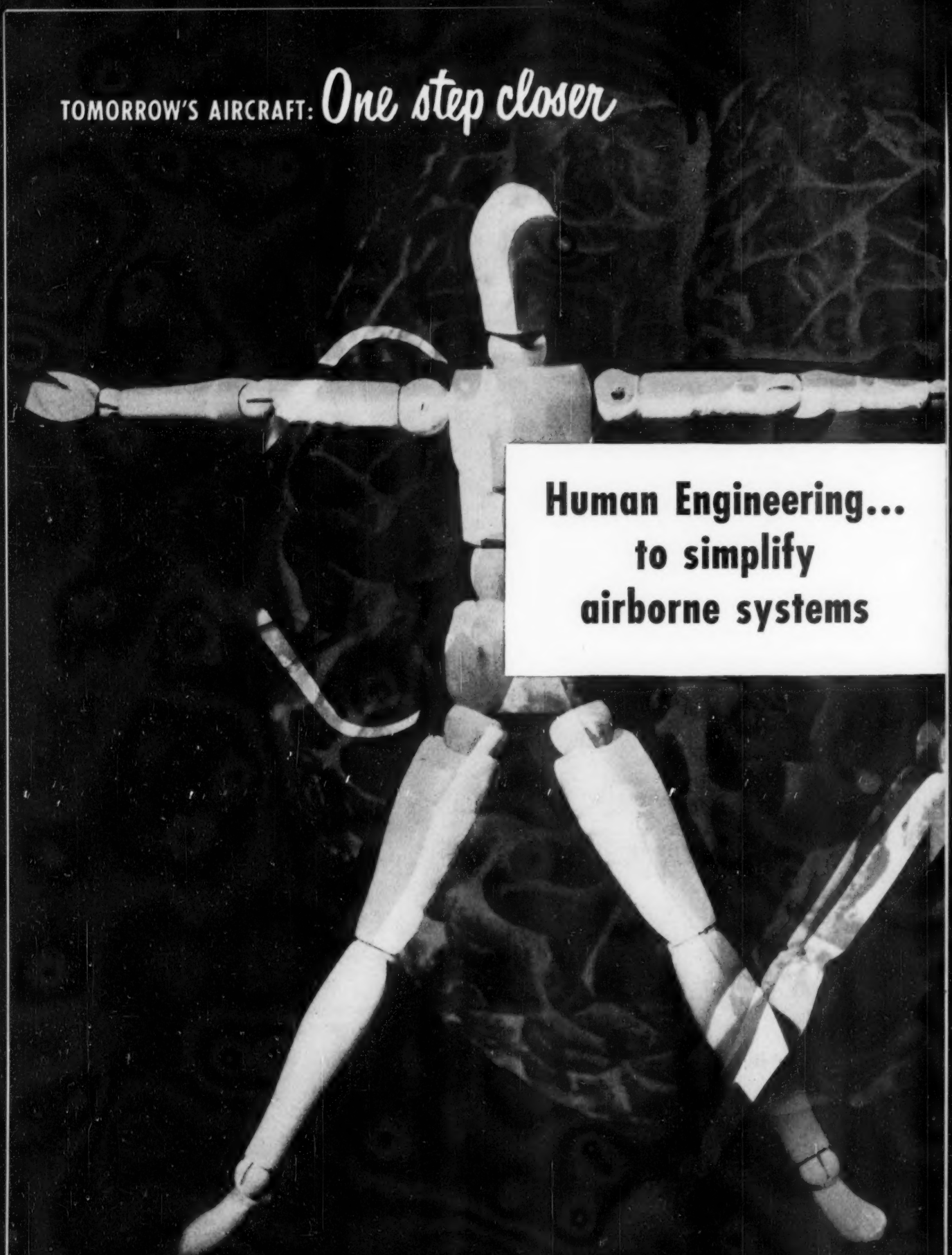

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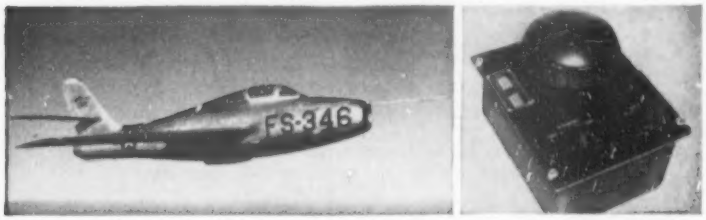
to simplify
airborne systems

Human Engineering has become a primary factor in the design of Westinghouse Avionics Equipment. Through scientific study and experienced evaluation of operational problems, Air Arm Division is using this principle to develop better airborne systems and permit aircrews to perform vital tasks quickly, simply and surely.

This is shown in Westinghouse Fire Control Systems. To make the equipment truly effective, it is necessary to analyze what the operator must perceive, interpret and translate for successful operation. The effects of enemy nullifying evasive action must also be considered. Specific Human Engineering studies then indicate the extent of automatic devices, placement and shape of controls, presentation of information, reaction time factors, sequence and method of operation. Such scientific facts, coupled with Air Arm experience, result in optimum compromise between operator's capability and engineering feasibility . . . and a product designed with all the possible benefits to accomplish the required mission.

This progressive concept of product design comes from Air Arm, a wholly owned Westinghouse Division, devoted to the manufacture of autopilots, airborne radar, complete fire control systems, computers and guided missile components. Complete development, production, flight testing . . . and now Human Engineering . . . facilities concentrate unparalleled capabilities on the problem of bringing more practical, simplified—and reliable—airborne systems One Step Closer. J-91011



A Westinghouse Human Engineered Autopilot is used in the Republic Aviation F-84 Thunderstreak, shown above. At right is close-up of autopilot console, designed with minimum number of controls for maximum simplicity.

THE SCOPE OF WESTINGHOUSE IN AVIATION

Basic aircraft systems

Turbojet Engines, Fire Control, Radar, Autopilots, Communication Equipment and Electrical Systems.

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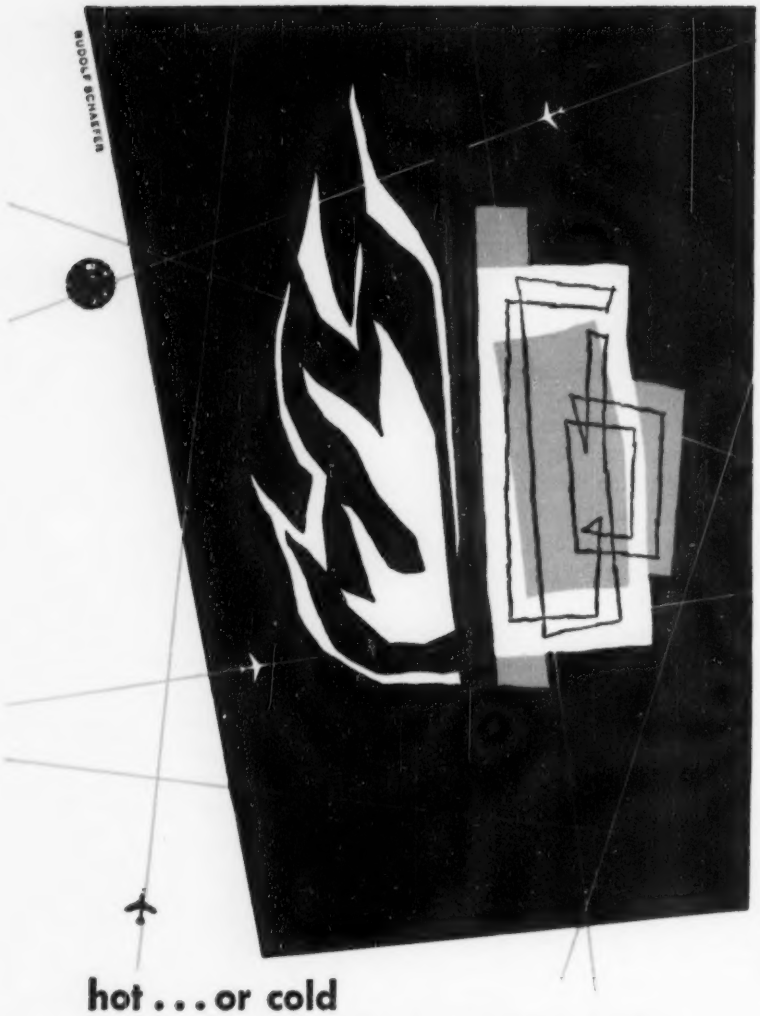

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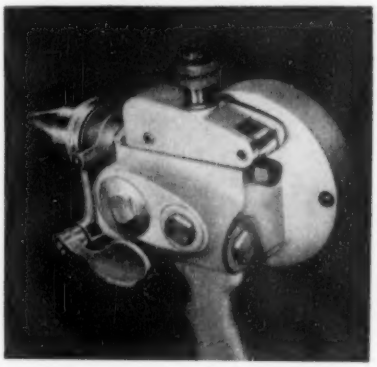
Thermocouple Speedwell protection tube is made of stainless steel to resist corrosion both inside and outside. Neoprene is the standard sealant, with Teflon or asbestos graphite also available. End fitting locks and seals 20-gage or 24-gage insulated duplex thermocouple in well. Seal is effected by compressing the Neoprene washer around the wires. Unit is supplied with a stainless steel adjustable midlock tube fitting for sealing and adjusting immersion of protection tube into vessel. Various lengths are available in the protection tube, straight or with 90-deg. bend. Diameter is 3/16 in. x .035 in. wall. End fitting is ¼ in. hexagon by 1-1/16 in. long.—Conac Corp., 4515 Main St., Buffalo 21, N. Y.

Half-horsepower aircraft motor is open, self-ventilated, rated for continuous duty up to 35,000 ft. Output speeds are available from 1,500 to 5,000 rpm. Designated type GA, the unit operates on 3-phase, 400-cycle alternating current. The design will reportedly meet USAF specification 32590. Leading features claimed for the motor are thermal overload protection, integral cooling fan, hardened and shaved helical gears, internal spline takeoff shaft, AN mounting pad, rapid acceleration and high torque.—U. S. Electrical Motors, Inc., Aircraft Div., Terminal Annex, Box 2058, Los Angeles 54.

Metallizing machine, called Vanco, is said to eliminate the need for manual adjustments through incorporation of a new type nozzle. Unit is reported to be lightweight, compact and easy to operate. All bearings for the wire feed mechanism are encased in the main



body gear case casting. Backfire is eliminated by means of a gas mixing chamber which is built in the nozzle at point of combustion.—Vandersee Engineering Co., Inc., 727 W. 7th St., Los Angeles, Calif.

Another Thompson "First"...

T.P.M.

makes the big difference in valve life

These two Thompson valves from Pratt and Whitney Aircraft R-4360 Engines were photographed after first overhaul.

T.P.M. is the new valve material developed by Thompson to give greater corrosion resistance and higher strength at valve operating temperatures. T.P.M. is a result of Thompson's vast experience in valve development and knowledge of the behavior of metals at high temperatures.

Other Thompson "firsts" include a new coating alloy for valve heads and faces, and stem-peening to provide harder, more wear-resistant stem surfaces.

VALVE DIVISION

Thompson Products, Inc.

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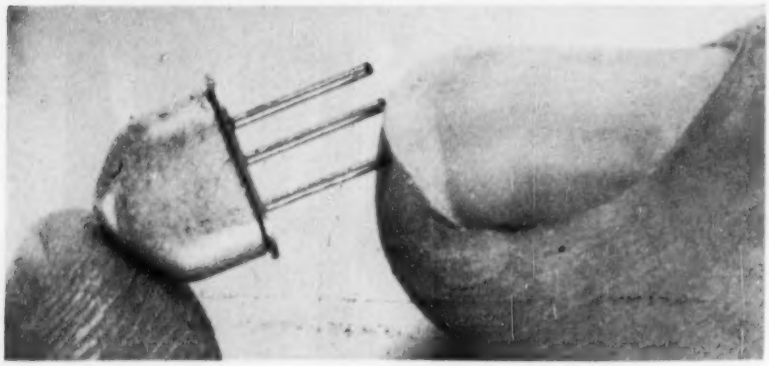
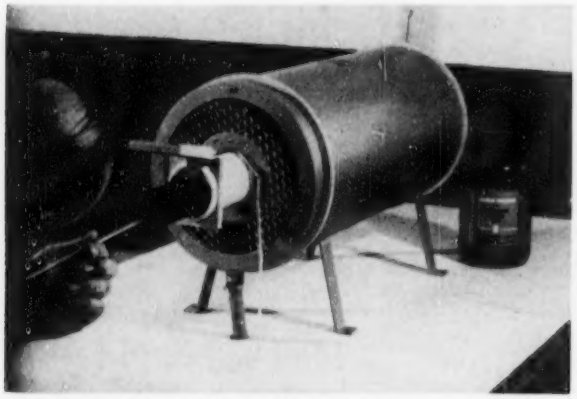
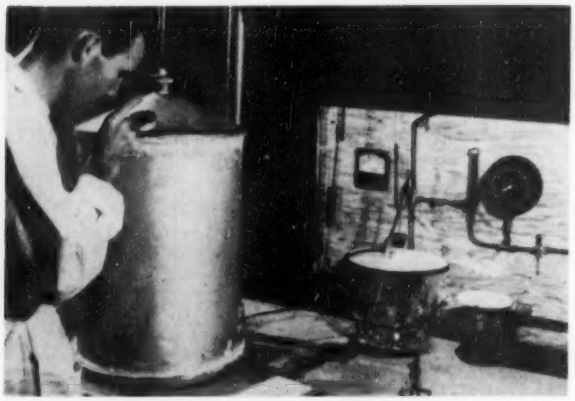


1. TRANSISTOR production, from a soft-white powder called germanium dioxide to a thumb-nail size unit (left) is a difficult, complicated process involving metallurgy, microscopes and exceptional manual dexterity. Close checking must be continued throughout the process. This unusual series of photos taken at Hydro-Aire, Burbank, Calif., details important steps in manufacture of a point-contact transistor.

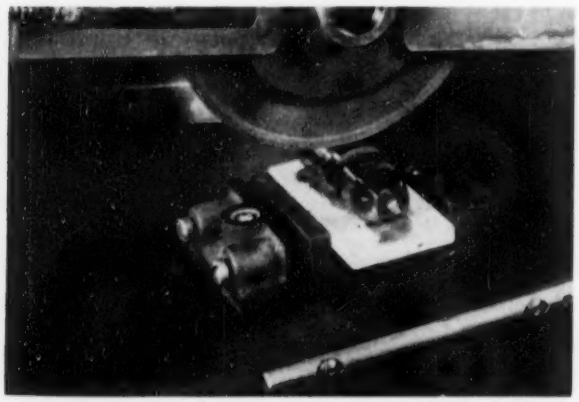
How a Transistor Is Born



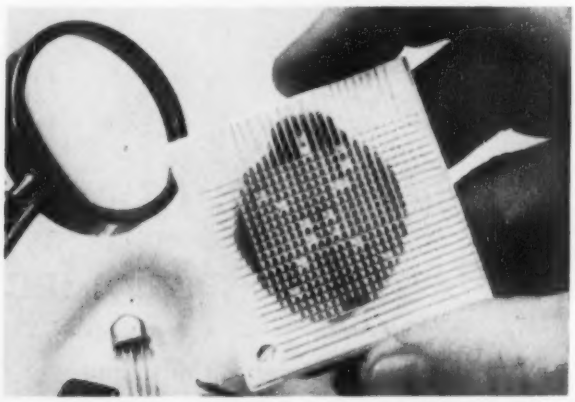
2. BAKING the essential ingredient, germanium dioxide, in a hydrogen atmosphere is the first step in the life of a transistor. This stage of the process produces the required germanium ingot.



3. GROWING furnace converts the ingot into a single crystalline structure. A helium atmosphere is also maintained in this furnace to insure exclusion of undesirable impurities.



4. SLICING crystal into sections approximately 0.020-in. thick is done (above) after purity check, made by measuring crystal's resistivity. Purity must be in order of one part in ten million of germanium.



5. DICED germanium following cross-cutting into particles approximately 0.040 in. sq. Each of these will become a transistor. Next, particles are etched and cleaned. (Picture story continues on p. 77.)

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New IRC VARISTORS are voltage sensitive, non-linear resistors. They provide a sharp variation of resistance with applied voltage. They are supplied in 5 convenient cell sizes with a complete choice of enclosures, including hermetic seals.

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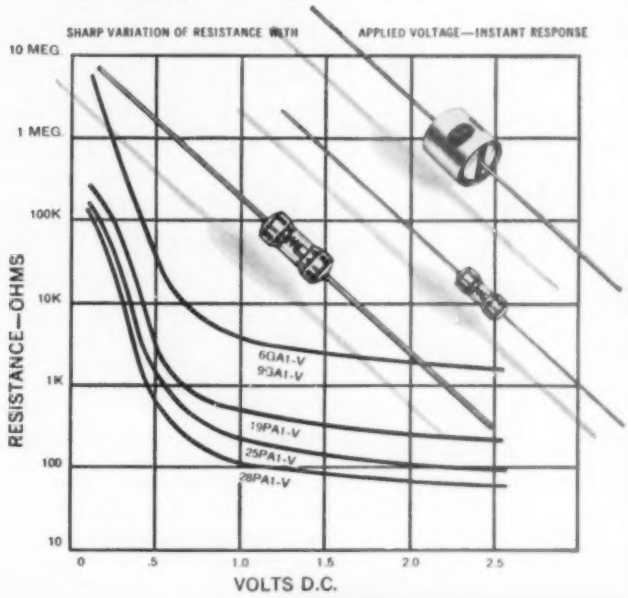
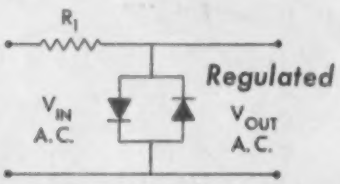
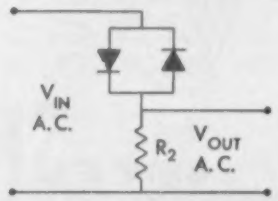


TYPICAL APPLICATIONS

VOLTAGE REGULATION OR SIGNAL CLIPPING.



LOGARITHMIC CONVERTER. Large changes in output voltages are obtainable with small changes in input voltages.



TYPICAL COSTS

Type 25PA1-V, in lots of 500: 25c each. Type 90A1-V (hermetically sealed in glass) in lots of 500: 45c each.

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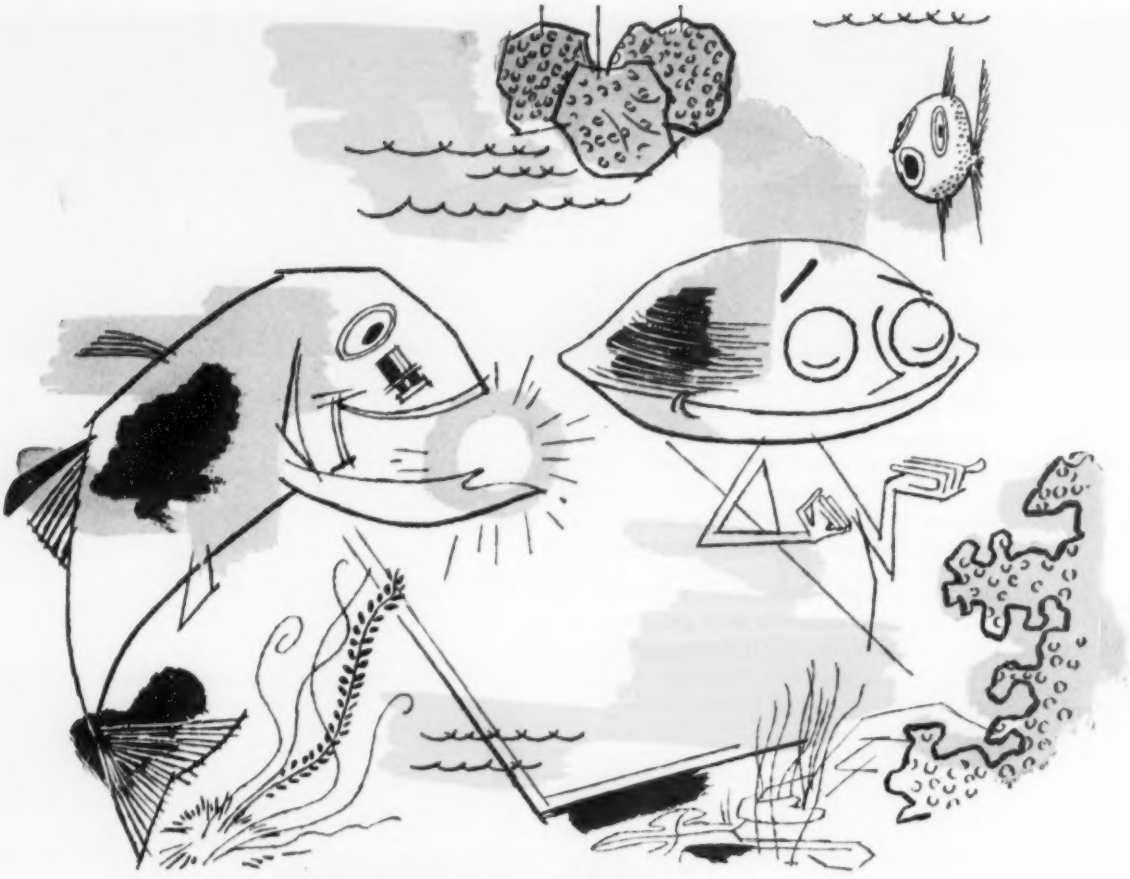

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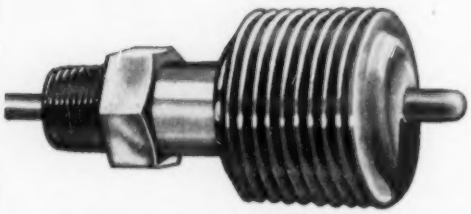

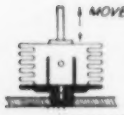

Thermostatic Motor—This type of assembly is widely used in temperature regulators, etc., where a thermostatic charge is confined in the bellows and where a valve, switch, damper, etc. is to be operated in response to temperature changes.

● Take bellows assemblies, for example. Designing and producing them is a specialty at Fulton Sylphon and Bridgeport Thermostat. Has been for over a half-a-century. So it's only natural that so many users of bellows assemblies come to us.

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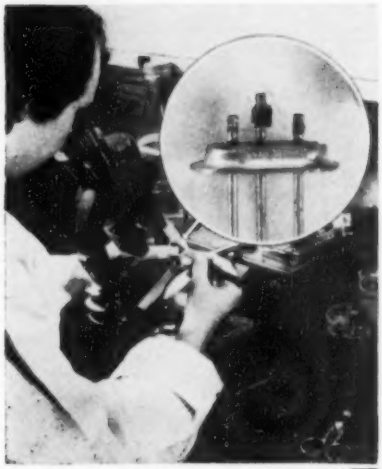
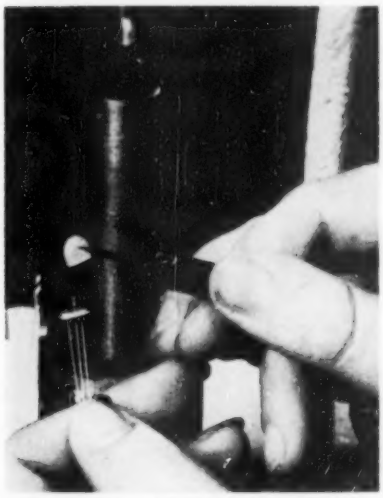


6. ASSEMBLY of germanium particle and wire "cat's whiskers" is done with tweezers under a microscope. Wire spacing (approximately 0.001 in.) has critical effect on performance.



7. SEAL hermetically encloses transistor elements after preliminary testing and adjustments. Hydro-Aire was one of the first firms to produce hermetically sealed units.

8. FINAL TEST measures the unit's amplification (alpha) over a range of input signal frequencies. Laboratory-type techniques needed indicate why transistors presently are expensive and hard to make.

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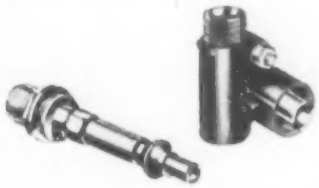

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LIFE SAVER—Only a few minutes after bailing out of his crippled jet fighter, this Air Force pilot was rescued from the Yellow Sea off Korea by a Sikorsky H-19 helicopter. Such "Guardian Angels" hover just out of enemy range, ready to answer emergency calls. The rescue technique shown is responsible for saving hundreds of U. N. pilots.

AROUND THE WORLD WITH SIKORSKY HELICOPTERS

PRISONER EXCHANGE—During the exchange of sick and wounded war prisoners in Korea, Sikorsky H-19 helicopters of the Army's 6th Transportation Helicopter Company flew a steady shuttle between the exchange point near Munsan and hospitals in Seoul. Six patients were carried on each flight during the week-long operation.

INTERNATIONAL SERVICE—Sabena Belgian Airlines in August opened the first scheduled international helicopter passenger service, supplementing its regular airline service to all of Europe, the Near East and Africa. Using big Sikorsky S-55s, helicopter flights will serve cities in Belgium, Holland, France, Germany and Luxemburg.

FAST SERVICE—With Sikorsky S-55 helicopters, the first regularly scheduled U. S. helicopter passenger service has been opened by New York Airways. In July, regular passenger flights began between LaGuardia, New York International, and Newark Airports in the New York City area. Only minutes are needed for inter-airport trips, which once took hours by surface vehicle.

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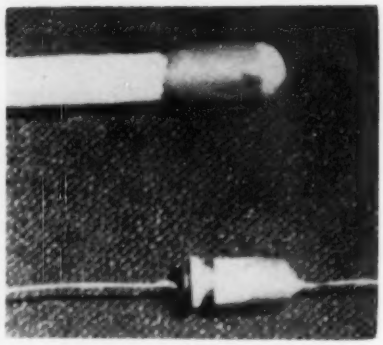
Midget Capacitor Matches Transistors

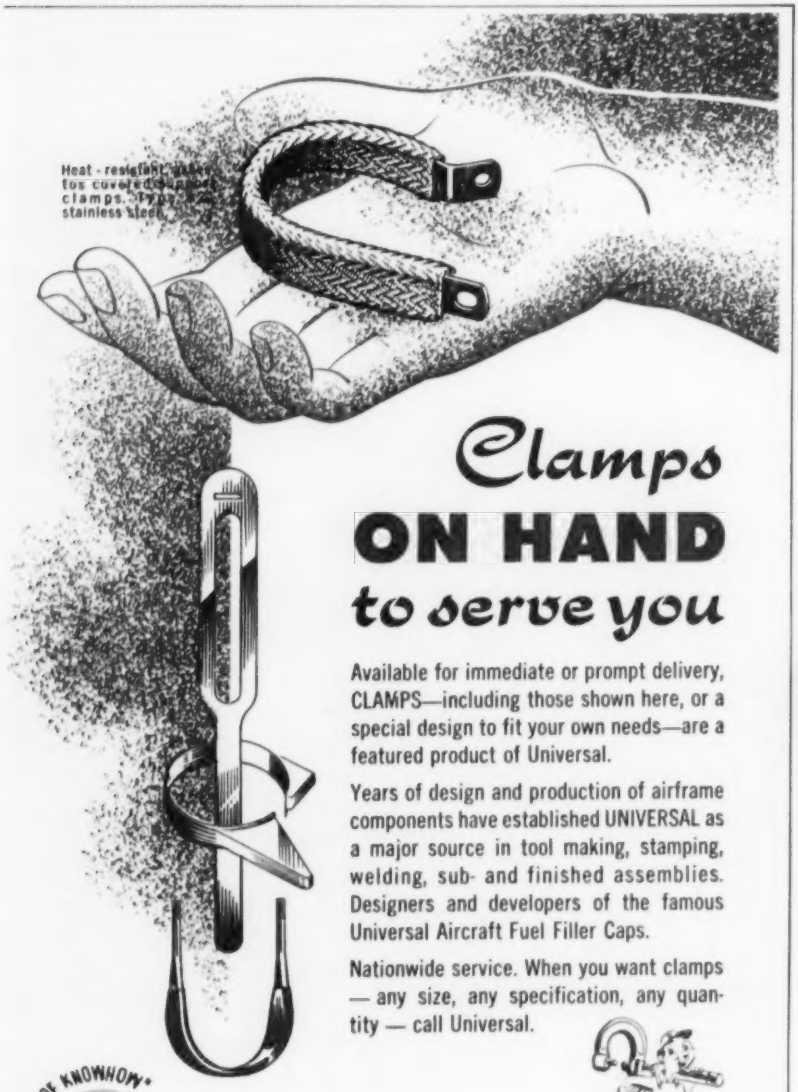
A new tantalum capacitor, smaller than the head of a kitchen match and possibly the smallest high-capacity, low-voltage capacitor yet developed, has been announced by General Electric's Capacitor Dept., at Hudson Falls, N.Y.

The new electrolytic capacitor is the first of a new GE line designed for use in transistor circuits. It should enable engineers to realize more of the long-heralded space-saving potentialities of tiny transistors.



GE's capacitor, which measures ¼ in. in diameter by ⅛ in. long, is available in ratings of 0.7 to 4 microfarads with voltage ratings of 2 to 16 v. A slightly larger capacitor, ¼ in. long, is available in 1.5 to 8 microfarad sizes and the same voltage ratings. Temperature range is −20C to 50C, but units can be operated at lower or higher temperatures with some voltage or life derating, GE says.

The new capacitors use a non-acid electrolyte and are sealed against leakage or contamination. GE says units exhibit long shelf and operating life and low leakage current. They are recommended for use in non-resonant, non-critical applications such as coupling, by-pass, and filtering.



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▶ **Transformer Design Manual**—The Armour Research Foundation has devised a nomograph method of designing small power transformers which it says greatly reduces the cut-and-try type of calculations previously required.

▶ **GE Autopilot for F-105**—General Electric has been selected by Republic Aviation to design the automatic pilot for its new F-105 after a hot design competition in which Minneapolis-Honeywell and Westinghouse were reportedly close contenders.

▶ **Missile Simulator**—A three-axis-of-freedom simulator, called the largest and fastest yet constructed, for use in testing automatic controls used in aircraft and missile guidance, has been developed by the Armour Research Foundation for the Armament Lab at Wright Air Development Center, Dayton. —PK

NEW ALTITUDE CONTROL

Improved altitude controllers for new Minneapolis-Honeywell E-11 automatic pilot, slated for use on the F-89D, F-101, and CF-100, are shown undergoing final inspection. The devices which provide signals proportional to displacement and rate of change of displacement of airplane from pre-selected altitude, will respond to barometric altitude changes as small as two feet, M-H says.

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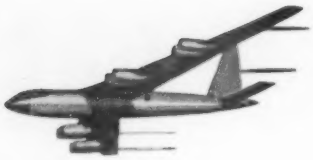

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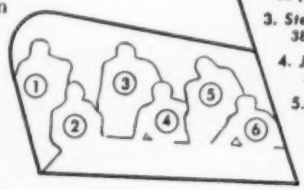

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FINANCIAL

New Progress Pay Policy Studied

Aircraft industry will have no trouble getting money from banks, but dividend restrictions are likely.

The squeeze on progress payments as a result of a tighter Defense Department policy in financing aircraft production is being studied carefully by industry observers. Its effect on earnings and financial programs will undoubtedly be important, but will vary throughout the industry.

Utilization of progress payments has been a major means of financing aircraft production contracts and has had a tendency to obscure the more conventional sources of funds which presumably soon will be called into greater play.

Aircraft contractors with prime contracts should experience little difficulty in obtaining necessary capital to finance operations.

▶**Government Policy**—As a matter of fact, the government has long insisted that private banking sources be used before calling upon the government for financial assistance. A directive issued by Robert Lovett, then Deputy Secretary of Defense, on Oct. 14, 1950, declared:

"In determining what form of financing shall be recommended or made available, the following order of preference should generally be observed . . .: (a) Private financing without government guaranty; (b) progress or partial payments; (c) guaranteed loans, with financing institutions participating to an extent appropriate to the risk involved; and (d) advance payments."

In viewing these financing sources, working capital requirements are primarily involved. Other conventional means are available to finance plant expansions which entail the purchase of plant sites, buildings, and related equipment.

▶**Dividend Restrictions**—With aircraft earnings, on the whole, on a relatively high sustained basis, augmented dividend payments have been anticipated this year and next. Should substantial bank borrowings now become necessary, credit agreements are likely to contain restrictions against dividend payments which would tend to reduce working capital positions unduly.

The important element remains as to how the price of capital so acquired will be absorbed in operating cost structures of the separate companies. On cost-plus-fixed-fee type contracts, interest generally is a reimbursable item and earnings should therefore be unaffected. This type of award, however, is now of limited application and carries relatively smaller profit margins.

▶**Effect on Profits**—Under fixed-price awards of the Air Force, which are more widespread, interest charges are not allowable as proper costs in establishing contract prices. In other words, this cost of doing business will have to come out of the contractor's gross profit margins.

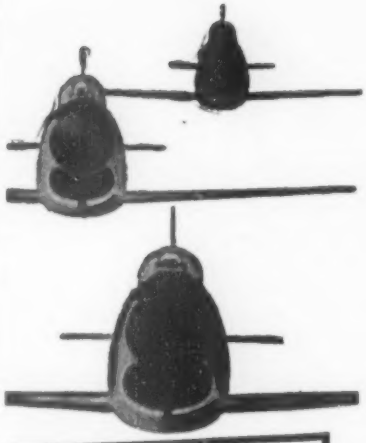
But no uniformity will prevail as to the final consequences. In the first place, an offsetting factor will be present in the tax credit. This will serve to reduce the added interest cost by 52%, providing no excess profits tax exists and the maximum corporate normal and surtax rate prevails. Finally, far more important and conclusive is the effect on net earnings after the Renegotiation Board passes on the company's operations.

The fact that a builder was more dependent on financial resources obtained on its own, is likely to be a favorable factor in the degree of earnings the Renegotiation Board may permit the company to retain.

▶**Types of Loans**—Commercial bank loans can take various forms. The principal types may be summarized as follows:

• **Ordinary commercial loans.** An aircraft company with an excellent financial rating can obtain bank loans solely on the basis of having a government contract. These loans are generally unsecured and are made without an assignment, proivding the borrower with a great deal of flexibility in conducting operations.

• **Bank loans secured by assignment of claims.** More prevalent in financing current operations under a government contract is the "assignments" privilege contained in contracts. Through this medium, the manufacturer may assign his right to receive payment to the lending bank. This permits the bank to receive payments directly from the government. Assignment of a claim under a contract does not in any way affect the other terms and provisions of a contract. The manufacturer still is responsible to complete delivery and file requests for payment before anyone can be paid. All the assignment does is to change the person or entity



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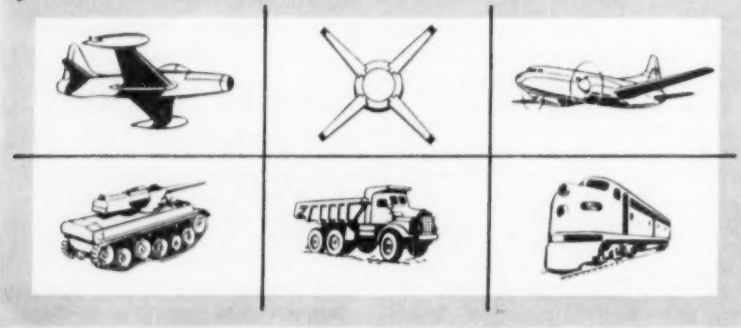


to whom the payment is to be made.

• **Government-Guaranteed Loans.** Under certain conditions, the risk element may be such that commercial banks will hesitate to grant loans to companies holding government contracts. To encourage loans under such circumstances, Congress passed Section 301 of the Defense Production Act of 1950. This permits government agencies to guarantee the lending institution that the government will absorb all or a specified portion of any loss resulting from nonpayment.

This policy is an outgrowth of the successful experiences of the V type loans during World War II. (During World War II some 8,000 individual V loans with an aggregate amount of $10 billion were guaranteed by the government.)

Government agencies who can now guarantee loans are: Departments of the Air Force, Army, Navy, Commerce, Interior, Agriculture, General Services Administration and the Atomic Energy Commission. While each of these guarantors has its own regulations on guaranteeing loans, a common pattern generally prevails:

• The amount loaned is based on need and a government determination as to the amount the financial condition of the lender warrants. The maximum amount loaned to any one borrower is not limited by statute.

• The Federal Reserve Banks are the central agency for clearing V loans for final approval.

• Interest rates to be charged by banks may not exceed 5% on loans for which guarantee is sought.

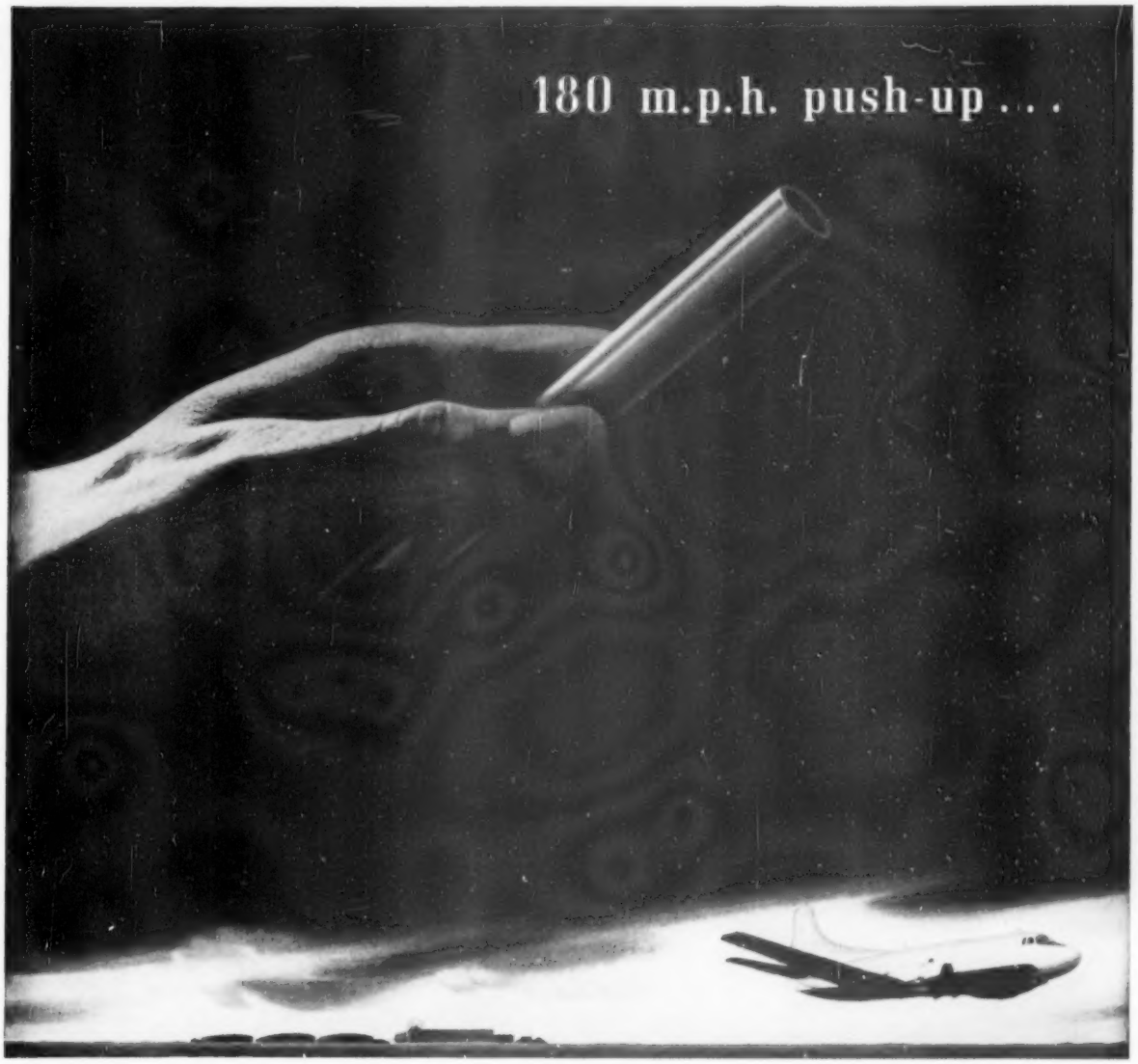
• The government guarantee may cover all, or part of the loan.

• The charge for guaranteeing a loan will vary with the proportion of the loan guaranteed. This government fee ranges from 1/10 of the interest on the guaranteed percentage of the loan, in the case of a guarantee of 70% or less, to ½ of the interest rate in case of a 100% guarantee. The cost of the guarantee is paid directly by the bank. The greater the risk the bank assumes, the less it pays in guarantee fees.

In all of these forms of bank loans it is customary to provide for various protective provisions. This is particularly significant at the present time in the light of the recently stated Department of Defense policy.

With 1954 the first likely year to feel the effects of adjustments in financial program as a result of the new Department of Defense directive on progress payments and with the Renegotiation Board generally unable to make its reviews for at least a year or two, it may be some time before the final consequences of the current policy decision may be known.

—Selig Altschul



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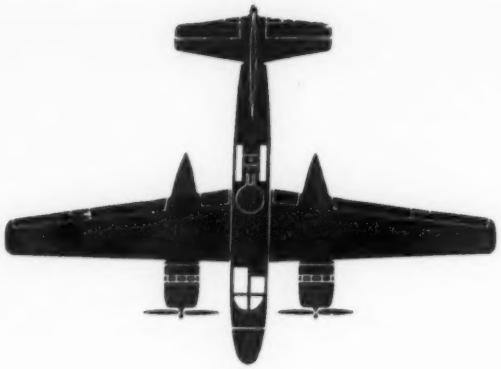

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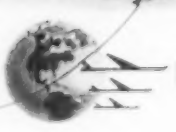
Depend on *DOUGLAS*  **First in Aviation**

Government Continues Financing Towers

- **Commerce staff study finds transfer of air traffic responsibilities to local governments is not practical.**
- **Administration probably will pay for CAA operation of airport control centers from fuel tax revenues.**

By Lee Moore

Commerce Department last week decided that Civil Aeronautics Administration should continue full operation of the 169 airport control towers in the United States after a study found transfer to municipal responsibility was not practical at this time.

The federal government plans to finance part of the local tower operation by increasing "user charges" to be levied on civil operators to help pay their share of the cost of CAA's Federal Airways Service.

This probably will take the form of an Administration request that Congress raise the money through the aviation fuel tax.

▶**Practical Alternative**—These decisions resulted from a study by Undersecretary for Transportation Robert Murray, who found that transfer of local tower operations to municipal responsibility was possible but not practical under present circumstances.

The increase in user charges (over those originally planned to pay for federal airways operation only) is the department's alternative to its previous hope that a practical way might be found for cities to carry their share of the local tower operation responsibility.

▶**Tower Policy**—Murray said he initiated a Commerce Department study last summer to find if there was any way to divide the traffic-handling responsibility among federal and municipal governments and users. This is in line with the Administration's "examination of everything," the Undersecretary told AVIATION WEEK.

Murray's staff decided the federal-local division could be made between instrument and visual flight conditions.

The staff's reasoning held that planes flying on visual contact enter the local area on their own and are local traffic from a practical standpoint, regardless of where flight originated.

Tower personnel on this type activity could be identified, and number of visual flight landings and takeoffs counted to show local financial responsibility.

On instrument flight operation, CAA Airways Service blends right into tower control, making bad-weather local operation a federal responsibility all the way. This was the theory.

▶**Academic Simplicity**—Staff members checked this plan by a survey of opinion of 16 municipal aviation authorities. Of the 16, eight said they probably would go along with it and pass the added cost on to the airport user (in higher airport charges), but they would have to check further to give full confirmation.

Three said they would close down their tower operation. An additional three said they didn't know.

Only two cities said the plan was sure to work smoothly with them.

Commerce Department and CAA studied the pros and cons and decided the plan would not be practical in operation, despite its academic simplicity of division between federal and local responsibility.

▶**Airport Aid Outlook**—Commerce is near a decision on the equally important problem of federal-local responsibility for airport development.

An industry panel is advising the department on the question of whether the federal government should get out and stay out of the airport aid program, which theoretically pays half the cost of needed construction.

Murray told AVIATION WEEK that some competent, important segments of the panel, "friendly to aviation," believe airport development will prosper more if the federal government stays out of construction financing and planning. But the report of this industry advisory panel will carry "dissents, and dissents to the dissents," he said.

Outlook is that the Administration will urge Congress to kill the entire federal airport aid program, despite the fact that some segments of the aviation industry strongly oppose such action.

Pressure tactics such as those of Buffalo, N. Y., to try to get all of the federal airport subsidy reserve will not work, Murray said. Decision on federal airport aid will be made without regard to local pressures, he emphasized.

▶**Airline Concern**—Murray told AVIATION WEEK the airlines, in particular, had become unduly concerned over the Commerce Department tower study as a threat, whereas it was aimed at getting the facts and deciding afterward.

The Undersecretary welcomed an invitation to speak to United Air Lines executives in Chicago last week, as an opportunity to enlarge upon the Republican Administration policies and programs in civil aviation.

The airlines had expressed deep concern over the Commerce study aimed at possible change of control tower responsibilities, but Murray told AVIATION WEEK that this was merely one of many normal studies made by the new Administration without any preconceived notions of how they would come out.

▶**Policy Forecast**—Here is a summary of Murray's review and forecast of Administration policy on civil aviation: CAA will continue its contributions to overall aviation safety and efficiency.

The new Administration has trimmed large chunks of non-essential activity from the budget, but actually has forwarded the federal responsibility for safety of interstate operations, Murray said.

▶**CAA Expansion**—Murray reviewed for AVIATION WEEK a few examples of CAA expansion that was going forward under the present Administration:

- **Fringe CAA activities**—such as airport advisory service, "education" and noise abatement—have been given back to the industry and local governments. The Undersecretary says the two can do a better job on these local aviation problems.
- **"Designee program,"** giving active industry mechanics and other specialists CAA authority, will go forward. It will help industry as well as budget reduction, Murray says.
- **Radar traffic control,** fully implemented at Washington, D. C., will be expanded as rapidly as possible in other high-density areas.
- **VOR airways** now cover 52,000 mi. of primary airways and 20,000 of alternate routes, compared with 35,000 and 10,000 respectively on June 1, 1952.
- **Other programs** going forward include: integration of en route communications centers with towers; extension of central traffic control communications range up to 175 mi. beyond the traffic area by remote VHF stations and installation of more than 100 of 450 DME facilities.

Where necessary to forward its pro-

grams as they develop during Commerce, CAA and Air Coordinating Committee studies, the Administration will ask new legislation, Murray says.

Management Firm Starts CAA Survey

The sprawling 15,000-man Civil Aeronautics Administration will go through a six-month efficiency and operations review by a leading management engineering consultant firm, Cresap, McCormack and Paget.

The survey is slated to start on or before Nov. 1, end before July 1, start of the next fiscal year. But changes will be made wherever and whenever they are found desirable as the study progresses, according to Commerce Department Assistant Secretary James Worthy.

Commerce last week was negotiating final terms of the $90,000-$100,000 survey contract with the firm.

▶ **Top to Bottom**—Worthy said the team will go over all phases of CAA. This will include Washington and regional administration, field agent functions and reporting, airport control tower operations, etc.

Worthy emphasized that the study implies no criticism of the present CAA but is typical of similar reviews under way elsewhere in the new Administration. CAA is the largest agency in Commerce Department.

Commerce has completed or soon will start similar studies on Bureau of Public Roads, Bureau of the Census and the new Business and Defense Services Administration—formerly NPA. The Roads study recently was completed by Booz, Allen & Hamilton, who reorganized Civil Aeronautics Board two years ago under the chairmanship of Delos Rentzel. The BDSA survey was done by McKinsey & Co., and the Census Bureau review is in early stages of negotiation with a firm as yet undisclosed.

▶ **Advice on Policy**—Commerce is using ad hoc industry committees and reports on the policy side of its various agencies. For example, advice of the Weather Panel (including airline, corporate and private flying experts, among others) soon will produce substantial improvement in certain weather services to aviation, Commerce Undersecretary Robert Murray recently told AVIATION WEEK. On CAA policies, the airlines and other interested groups submitted written recommendations to Murray early last spring.

▶ **Joint Project**—Worthy plans to assign one of his top staff men as liaison on the project and CAA administrative assistant Sam Kemp will assign one or more of his staff to work with the group.

CAB ORDERS

(Oct. 12-18)

GRANTED:

North Central Airlines temporary permission to serve Manitowoc, Wisc., with only one roundtrip per day on Route 86.

Resort Airlines special permission to serve Varadero, Cuba.

Kodiak, Alaska, and Northwestern Alaska Chamber of Commerce intervention in States-Alaskan route case.

State of Illinois intervention in Ozark Air Lines route renewal case.

AA FLIES FIRST DC-7 ACROSS THE U. S.

First Douglas DC-7 Wright Turbo Compound-powered transport delivered to American Airlines was flown from California to New York nonstop last Monday in 6 hr. 52 min. (see story on p. 17). American plans to begin DC-7 nonstop coast-to-coast scheduled service Nov. 29 with planes making the flight in less than eight hours each way. The transcontinental nonstop version of the DC-7 grosses 122,200 lb., has 5,512-gal. fuel capacity. AA has 25 DC-7s on order.

Braniff Airways final domestic mail rate of 53 cents a ton-mile, Oct. 1, 1951, through Nov. 9, 1952. CAB rejected a Post Office proposal to require Braniff to set up an "earnings equalization reserve" to offset possible later losses that would require increased mail rate.

Pan American World Airways permission to operate coach service from Seattle to Honolulu. Special exemption was needed to increase capacity of this segment, because PAA's present certificate limits flights on this route to through service to the Orient.

Fayetteville, Ark., service case intervention by Delta-C&S Air Lines, Little Rock, Ark., and Postmaster General. CAB denied petition of Dallas and dismissed that of Trans-Texas Airways.

APPROVED:

International Air Transport Assn. resolution adopting special reduced "B-Class service" rates in the Middle East.

Routine inter-airline contracts among 29 groups of parties.

DEFERRED:

United Air Lines Chicago-Seattle nonstop decision. CAB ruled that Northwest Orient Airlines may not be strong enough now to take direct competition on its transcontinental route but may be soon because of recent and imminent Board decisions aimed at strengthening NWA's service pattern. CAB members Joseph Adams and Josh Lee dissented, urging at least a temporary, one-year trial. They said Northwest is strong enough now, and public should have more service on the disputed route.

SUSPENDED:

Pan American's reduced charter rates to armed forces. CAB previously suspended similar cut-rate proposals by United and Northwest for defense charters. Board says reduced tariffs to the military discriminate against civilian contractors.

CANCELED:

Federated Airlines letter of registration, which apparently ceased operations early this year and failed to claim letters addressed to it by CAB at its last address.

DISMISSED:

Braniff from the Denver service case at company's own request.

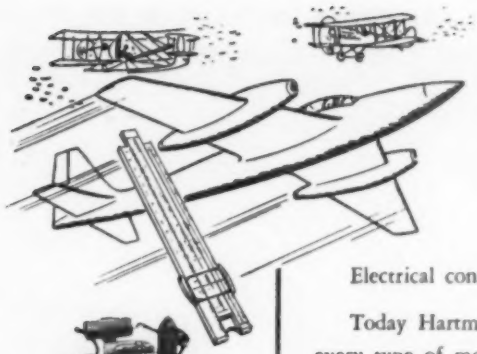
Pacific Northern Airlines complaint against Northwest's cut-rate passenger fare on southbound cargo planes from Anchorage to Seattle.

DENIED:

Muskogee, Okla., consolidation of its request for consideration of nonstop service by Central Airlines to Oklahoma City in the Fayetteville, Ark., service case.

Eastern Air Lines request that CAB dismiss Argonaut Airways, Continental Charters, Miami Airline and Peninsular Air Transport from the large irregular carrier investigation.

National Airlines and Braniff motions that CAB expedite the reopened North America-South America interchange ("Balboa Service") case by certifying the old record for decision without further procedural steps. The President had asked CAB to review the case largely in light of the fact that it was so old that evidence required updating.



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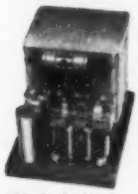
Phase Sequence and Phase Failure



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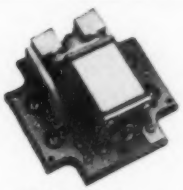
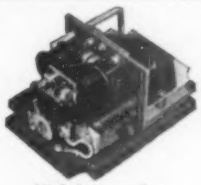
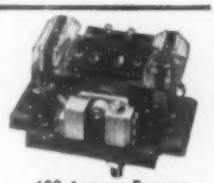


600 Ampere Contactor

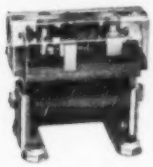


High Interrupting Capacity Cutout

USAF Type T-1 High Interrupting Capacity Contactor

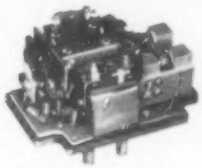


600 Ampere Reverse Current Cutout AN3025-2

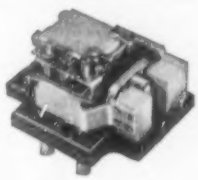


Control Relay *(without cover)*

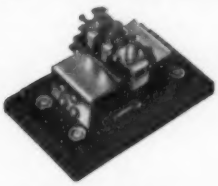
Equalizer Relay



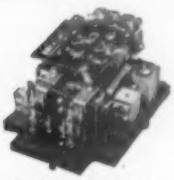
1000 Ampere Reverse Current Cutout



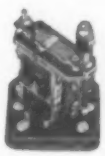
Jet Starter Relay



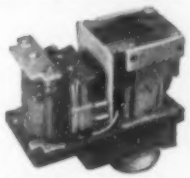
Undercurrent Relay



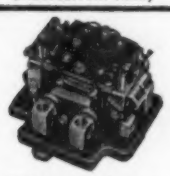
Fault Sensing and Generator Control



Overvoltage Relay



Generator Field Relay or Exciter Control Relay



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Nonsked Lines Face Hard Times

Many nonscheduled airlines face hard times in the coming year, politically and economically. Main reasons:

• **Government crackdown** on nonsked violations of Civil Aeronautics Board regulations restricting non-certificated (nonsked) carriers from route-type service.

• **Military contract** reductions due to budget cutback and Korean truce.

• **More competition** among nonskeds and with scheduled airlines and railroads. Rails are cutting rates bid for official military troop movements, despite upward trend of other rail fares.

A few nonskeds eventually may win certificates, and a few more will continue doing a fair business on strictly charter work, which CAB permits.

The others have two possible major roads of survival:

• **Government easing** of certification requirements through changes in present attitudes of CAB, the Administration and Congress.

• **Favorable interpretation** by a federal court of the Civil Aeronautics Act and CAB powers under it.

• **More government contracts** from military, Post Office and other agencies.

Washington observers do not foresee those developments in the immediate future.

▶ **CAB's Nonsked "Problem"**—The "nonsked problem" arose after World War II when many persons leased or bought surplus aircraft, and the Board waived certification requirements for them to fly charter-type services. They, therefore, were called "nonscheduled airlines."

To win the privilege of flying scheduled air service, an airline must prove public convenience and necessity for its proposed route services under the Civil Aeronautics Act.

▶ **Curbed Expansion**—Many nonskeds expanded their services with demand and became, in effect, scheduled airlines without certificates.

CAB decided in the transcontinental coach case that there was no need for new certificated aircoach services. In the trans-Atlantic cargo case, the Board decided there was no need for new trans-Atlantic certificates.

But the nonskeds have continued fighting for rehearing through the courts, Congress, Administration and CAB.

Some have violated Board restrictions, but CAB has been hard put to stop this through enforcement proceedings, largely because of the delays of due process of law in the courts.

▶ **Prime Target**—The wheels of due process of law grind slow, but the Board's machinery of enforcement action against nonskeds is speeding up. Repeated court precedents are narrowing the issues.

Biggest domestic nonsked and prime target is North American Airlines.

The airline group recently won a court order delaying Board hearings on charges that member carriers violated regulations by operating scheduled flights (Aviation Week Sept. 14, p. 118). But NAA subsequently agreed to waive oral arguments and speed up the proceedings after Supreme Court Justice Stanley Reed slapped it down.

Said Justice Reed: "The administrative remedies offer ample protection to the applicant's rights and, until those remedies are exhausted, judicial intervention to halt the Board hearing is not justified."

▶ **Murray Decision**—Attitude of White House and Commerce Department has not been announced.

A Commerce staff team formed by Robert Murray, Undersecretary for Transportation, is making a study of the nonsked problem. Decision is virtually certain, however: Certification will be required for scheduled, route-type operations.

▶ **Questionable Support**—Nonskeds can count on support from some members of Congress.

But, as in the past, it is likely to be scattered, largely vocal and of questionable effectiveness.

The Senate Small Business Committee, headed by Sen. Edward Thye, will keep pressure on CAB to keep the nonskeds in business. So far, this has resulted only in more cautious and slower Board actions against nonskeds.

A special committee, the small business group does not have authority to legislate.

Outlook for support from Senate Commerce Committee has dimmed since a subcommittee, headed by Sen. John Sherman Cooper, was appointed in August by the former chairman, the late Sen. Charles Tobey, to review policy on air transport competition.

Cooper hopes to hold hearings this fall, but the subcommittee's two other members—Sens. Dwight Griswald and Edwin Johnson—are not expected to return to Washington to cooperate.

Commerce Committee's new chairman, Sen. John Bricker, probably will second the position of Johnson, who publicly has denounced activities of the nonskeds and expressed the hope that the Cooper Subcommittee "will not be used unwittingly as a vehicle to promote selfish interests (of nonskeds) rather than the public interest."

▶ **Subsidy Springboard**—Not likely to materialize is nonsked talk of a spectacular full-scale investigation of allegedly extravagant subsidies to the scheduled industry by the Senate's permanent Investigating Committee, headed by Sen. Joseph McCarthy. Such an investigation would create a favorable atmosphere for unsubsidized nonskeds.

The committee's staff is looking into complaints, but McCarthy told Aviation Week he does not expect the matter to go further than this.

Opposition to airline subsidies in House Appropriations Committee, when they come up for review in connection with CAB's budget next spring, may give the nonskeds a springboard to push their case.

▶ **Declining Volume**—Military contracts have been a large part of nonsked business.

As CAB and competition restrict nonskeds' common carriage more and more, the contracts will become even more important. Irregulars whose registration has been revoked by CAB must rely on contract business only.

Defense Department budget for personnel movements this fiscal year is about 25% less than last year. The Korean truce may cut it more next year. Pacific airlift phases out entirely June 1.

▶ **Mail Contracts**—Nonskeds have pressed Post Office and the Board for the privilege of bidding for the new first-class mail airlift service. But the Department has left this up to CAB.

The Board last week started an investigation to find if carriers other than those certificated for airmail carriage may haul this new class of air mail.

BAKER CHECKS COPTER

George T. Baker, president and chairman of National Airlines, tries the cockpit of a Sikorsky S-55 helicopter of the type NAL plans to put into service this winter in Florida's Tampa-Sarasota-St. Petersburg-Lakeland region. National is getting three S-55s, making it the first major U. S. trunkline to use helicopters. Also in photo are E. E. Gustafson (right), Sikorsky sales representative, and Kris Rossand, NAL stewardess.

RESEARCH

Photo shows air return passage of transonic wind tunnel at NACA's Langley Aeronautical Laboratory . . . biggest of its kind . . . cost $9,200,000 . . . requiring 60,000 horsepower to operate.

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GAVEL is presented to TCA president Gordon McGregor (second from right), new president of International Air Transport Assn. Present are, left to right: Herbert J. Symington, TCA director; Dr. Walter Berchtold, Swissair president and former IATA president; Sir William Hildred, IATA director general; McGregor, and the Hon. Lionel Chevrier, Canadian Minister of Transport.

REPORT was made to IATA general meeting by legal committee chairman H. J. Friendly (left), PAA, and committee secretary J. G. Gasdik, shown at a press conference.

International Executives At Montreal IATA Meet

DISCUSSION of the technical committee's annual report by Stanislaw Krzyczkowski, committee secretary (left), Capt. J. C. Kelly-Rogers, Aer Lingus, committee chairman (center), and P. Goldsborough, TWA, vice chairman.

ANNUAL REPORT gets close scrutiny of IATA financial committee secretary Dr. H. J. Gorecki (center). Listening, left to right: F. J. H. Johnston, assistant treasurer; H. T. Davoud, assistant secretary; J. H. Woodbridge, PAA comptroller and committee chairman, and A J. Quin-Harkin, IATA Clearing House.

ESCORT Canadian Prime Minister Louis St. Laurent with Mrs. Gordon McGregor, wife of TCA's president, at IATA dinner.

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SHORTLINES

▶ **Aerolinas Argentinas** plans to start service to Guatemala next month, although reports indicate that Taca and Pan American traffic to Guatemala are substantially lower than 1952.

▶ **Air France** is the second foreign carrier to join Air Cargo, Inc., (following Trans-Canada). ACI vice president and general manager Emery Johnson says Air France's Chicago, Boston and New York services led to its decision to use pickup and delivery services provided by this agency of U. S. scheduled airlines.

▶ **Canadian Pacific Airlines** planned start of scheduled Vancouver-Mexico City-Lima service Oct. 24 with sleeper and dormette DC-6Bs, 10 hr. Vancouver-Mexico City and another 10½ hr. to Lima.

▶ **California Aeronautics Commission** is publicizing for the benefit of potential airline customers that a new state legislative act requires all ticket agencies and airlines promising to sell airline seats to file $5,000-surety bonds. This is to curb the problem of stranding servicemen and civilians by dishonest and irresponsible brokers.

▶ **Delta-C & S Air Lines** vice president and comptroller Todd Cole says new planes on order will increase the fleet 55% by June 30, 1956. This compares with an 85% capacity for the combined DAL and C & S fleets 1948-52. Cost of 20 Convair 340s and 10 Douglas DC-7s is about $33 million, probably requiring $15 million bank credit, which would increase debt ratio to peak of 50% during period of maximum borrowings and minimum repayments, he says.

▶ **Lambert Municipal Airport,** St. Louis, will get seaborne-type arresting gear, plus runway lengthening by 2,200 ft. to total 10,000 ft. as proposed by McDonnell Aircraft Corp. and approved by the city's Board of Estimate and Apportionment. Cost is $850,000, of which city puts up $150,000 and the company $700,000.

▶ **Oakland Municipal Airport's** Board of Port Commissioners says it will "look with favor on possible establishment of a $1.2-million Air National Guard base" there.

▶ **Riddle Airlines,** cargo carrier, proposes $47.50 San Juan-New York coach service to fill out directional load imbalance.

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11	12086-1C	Eclipse	Amplifier
19	15100-1B-A1	Eclipse	Pitch Trim Gauge
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15	22101-11-A4	Eclipse	Pressure Trans.
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23	20100-11C-4-A1	Eclipse	Wing Flap Indicator
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75	1416-19E	Eclipse	Starter
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34	9804B	Vapor Car Heating Co.	Control Box
25	46B311	Vapor Car Heating Co.	Compensator
202	A812	Interstate Aircraft & Eng. Co.	Solenoid
46	146102	Bendix	Valve (0-500 PSI)
240	1265-900	Airex	Relief Valve
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53	AN6203-3	Bendix	Accumulator 10"-1500 P.S.I.
140	K14949E	Marquette	Windshield Wiper Kit
188	EYLC-2334	Barber-Coleman	Control
230	921-B	Stewart-Warner	Heater (200000 BTU)
30	0655-D	Aro	Oxygen Regulator
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130	612-4A	Eclipse	Valve
2200	37D6210 (AN4078-1)	United	Solenoid Valve
1888	K1593-6D	Kohler	Valve
500	NF3-5	Mallory	Noise Filter
20	TA-12B	Bendix Radio	Transmitter
35	RA10-DB	Bendix Radio	Receiver
2585	AN3096-4	Grimes	Dome Ligh
775	AN3096-5	Grimes	Dome Light
1365	AN3096-6	Grimes	Dome Light
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550	PD12K10	Stromberg	Carburetor
236	PR48-A1	Stromberg	Carburetor
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19	1375F	Holley	Carburetor
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185000	LS4-AD1	Aero	Spark Plug
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200	84350-D	P & W	Crankcase Ass'y
281	CR2791-G100-K4	G.E.	Relay
626	CR2792F101-A3	G.E.	Relay
41	G34464	Guardian	Relay
350	G31502-A	Guardian	Relay
22	146102	Vickers	Brake Valve
9	557-5	Eclipse	Check Valve
107	D12296	Adel	Pump
67	19100-2-101B	Kenyon	Check Valve
88	3135-11C	Eclipse	Pressure Switch
32	3V-217-HC	Pesco	Separator
100	27314	Purolator	Oil Filter
128	3801-3B	Eclipse	Fuel Quan. Gauge
33	420313	Wright Aero	Pump Ass'y.
46	416421	Wright Aero	Drive Ass'y.
76	U635A (AN4000-2B)	U.A.P.	Fuel Strainer
12	U8416-MM	U.A.P.	Oil Cooler Ass'y.
25	26675	Airesearch	Motor
35	AA14002A	Vickers	Accumulator
21	FD65-5	Diehl	Motor
81	3616	Bendix Radio	Control
23	3620	Bendix Radio	Station Box
335	G1 (94-32376)	G.E.	Oxygen Pressure Signal Ass'y.
180	AW-CV-1-1	U.S. Gauge	Check Valve
740	1C-200	G.E.	Radio Noise Filter
15	1EAR-280BH	Pesco	Pump
7	SP-1-445-2	Parker	Selector Valve
8	1E621	Pesco	Pump
99	NEP-2	Eclipse	Auxiliary Power Unit
16	LER-30D	Lawrence	Auxiliary Power Unit
4	2CM46A2	G.E.	Generator
6	2P248EB	Pesco	Fuel Pump
21	2E258SA	Pesco	Pump
146	AW2-3/4-95K	U. S. Gauge	Manifold Press Gauge(Metric)
27363	CREB3N	Casco	Rod End
18	SA/3A	Kidd	Impact Switch
12	3GBD1A18A	G.E.	Regulator
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402	NAF310310-5B	Cannon	Plug
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327	JAN 6AL5		Tube
959	NF10084		Radio Noise Filter
36	FM-1		Q.E.C. Unit
17	PY4M (B24)		Q.E.C. Unit
8	G16A2CA21	Minn. Honeywell	Pressuretrol
1865	73-A-01		Throttling valve

TIRES

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200	AN3-CH3A	782	-C12	103	-C12A
440	-C4	637	-C13	114	-C25
411	-C6	7742	-C20	102	-C36
8211	-CH6A	345	AN6-C7A	248	-C41
173	-C7	2543	-C7	155	AN6-C7
487	AN4-C4	1531	-CH7	139	-C14A
516	-CH8	2978	-CH7A	480	AN7-C21A
8714	-C7	188	-C11A	194	AN8-C15
80	-C10A				

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NEWS SIDELIGHTS

Companies dependent upon the management-troubled Hughes Aircraft Co. as sole source for important fire control systems have been seeking second sources. Westinghouse and Convair discussed the F-102 fire control system but reached no agreement. Howard Hughes, incidentally, is telling friends he has called off all plans to sell the company.

First production F4D is due off the Douglas-El Segundo assembly line late next spring. XF4D-1, now completing carrier suitability trials at Patuxent River, Md., has been okayed on tests for all operations required aboard a carrier.

One of President Eisenhower's top advisers is trying to upset plans for the President to unveil the atomic bomb on the 50th anniversary of flight national TV show Dec. 17 (AVIATION WEEK Aug. 10, 1953). After earlier approval, he now is recommending against it. Plans call for unveiling an early-model A-bomb as the climax of a report on the growth of air power. The official concerned feels too much public hysteria might be generated. The President, although he personally approved the plan, is reluctant to go ahead without agreement from this man. The official is not Lewis Strauss, chairman of the Atomic Energy Commission. Strauss okayed the idea.

Douglas B-66, USAF version of the Navy's A3D, will be much heavier than its Navy counterpart due to what some sources feel are Air Force "whims." B-66 requirement, for example, calls for ejection seats while Navy version will use an escape chute. Despite the fact that the A3D, unlike the B-66, must be stressed for carrier landings, USAF requirements call for heavier landing gear, redesigned wing and other features which will make the B-66 almost 5,000 lb. heavier than the A3D. B-66 will weigh in around 75,000 lb. compared to 70,000 lb. for A3D.

Air Force finally will let Northrop admit it is building the Snark missile. USAF has been holding back on production of the Snark, however, according to one company source.

NACA still is trying to overcome highspeed instability of the Douglas Skyrocket. In addition to wing fences, it is testing both an extended leading edge and a slated leading edge on the D-558-II.

The most scientific of all model aircraft contests, the radio-controlled duration record, now is held by Russia despite U.S. efforts to regain it.

Air Force Secretary Talbott turned thumbs down on North American Aviation's plan to hold the press flight demonstration of the F-100 at Edwards Air Force Base. March Air Force Base, Riverside, Calif., was suggested as an alternate, but Talbott refused to okay use of any Air Force Base for the press demonstration. The flight then was shifted to Palmdale Airport.

Convair's XF-92, delta-wing predecessor of the F-102, was damaged when its nose wheel collapsed while taxiing at Edwards Air Force Base.

Air Force investigators said four days after the crash of the Bell X-5 research plane near Edwards Air Force Base they still had not uncovered the cause. The X-5, world's first aircraft with variable-sweep wings, crashed 12 mi. east of the base Oct. 13, killing Maj. Raymond Popson, experimental test pilot.

Slick Airways in New York denied rumors last week that the company is selling two of its 4 DC-6As to UAT, French airline. Slick spokesman said Slick is negotiating bid for a Korean airlift on the basis of all four DC-6As.

Well-informed sources say that Eastern Air Lines is discussing with Douglas Aircraft officials possibility of purchasing an undisclosed number of speedy, Turbo Compound-powered DC-7s.

AVIATION CALENDAR

Oct. 28-30—Southeastern Airport Managers Assn., annual convention, Marlin Beach Hotel, Ft. Lauderdale, Fla.

Oct. 29-30—National Business Aircraft Assn., sixth annual meeting and forum, Park Plaza Hotel, St. Louis.

Nov. 2-3—Magnesium Assn., ninth annual meeting, Biltmore Hotel, New York. Convair's D. A. Tooley will discuss use of metal adhesives with magnesium.

Nov. 3-4—1953 Transport Aircraft Hydraulics Conference, sponsored by Vickers, Inc., Hotel Park Shelton, Detroit.

Nov. 4-6—Society of Automotive Engineers, meeting of Committee on Aircraft Hydraulic and Pneumatic Equipment, Statler Hotel, Washington, D. C.

Nov. 7—Air Education Day, sponsored by Junior Chamber of Commerce of Allentown, Pa., Allentown-Bethlehem-Easton Airport.

Nov. 9-12—Conference on radio meteorology, Austin, Tex. Sponsors include American Meteorological Society.

Nov. 16-17—American Society for Quality Control, conference of the Aircraft Technical Committee, Biltmore Hotel, Dayton, Ohio.

Nov. 17-20—Aviation Distributors and Manufacturers Assn., 11th annual meeting, Jefferson Hotel, St. Louis.

Nov. 19-21—National Aviation Trades Assn. 14th annual convention, Hotel Broadview, Wichita.

Nov. 23-24—Operations Research Society of America, fall national meeting, Statler Hotel, Boston.

Nov. 29-30—Society for Advancement of Management Conference, Hotel Statler, New York.

Dec. 1-2—American Society of Mechanical Engineers, frequency response symposium, Hotel Statler, New York.

Dec. 3-5—Seventh Annual Arizona Aviation Conference, Yuma.

Dec. 17—Seventeenth Wright Brothers Lecture, U. S. Chamber of Commerce building, Washington, D. C.

Jan. 25-28—Plant Maintenance & Engineering Show, International Amphitheater, Chicago. Conference will be held concurrently at the Hotel Conrad Hilton.

Feb. 3-5—Society of Plastics Industry, ninth annual division conference on reinforced plastics, Edgewater Beach Hotel, Chicago.

Apr. 5-6—Society of the Plastics Industry (Canada), Inc., 12th annual conference, Mount Royal Hotel, Montreal.

Apr. 29-30—American Society of Tool Engineers, 10th biennial industrial exposition, Convention Center, Philadelphia.

May 5-7—Third International Aviation Trade Show, sponsored by Aircraft Trade Shows, Inc., 71st Regiment Armory, New York.

May 12-14—Engineering Institute of Canada, annual meeting, Quebec.

May 31-June 11—Canadian International Trade Fair, held in conjunction with an international air show, Toronto.

June 7-10—Sixth National Plastics Exposition, Cleveland Auditorium, Cleveland.

July 13-15—Western Plant Maintenance Show, to be held concurrently with a Plant Maintenance Conference, Pan Pacific Auditorium, Los Angeles.

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EDITORIAL

What Are the Facts About Business Aircraft?

Two officials of National Business Aircraft Assn. take strong exception to a news story in AVIATION WEEK Oct. 5 that reported a new information service for business aircraft operators.

The new company is Robert Hewitt Associates in New York. The story did not refer to the Association either directly or indirectly.

"The statement in the first paragraph that 'reputable information about the field is scarce' is certainly erroneous and misleading," wrote Jean Dubuque, executive director of NBAA.

"Virtually all of the services Hewitt indicates that they plan to perform are currently being conducted by the Association. We have been carrying out these activities with little fanfare and it has really paid off through greatly increased membership," Dubuque writes.

"Perhaps the most amazing statement made by Hewitt is, 'Aircraft companies and manufacturing organizations are interested in producing new products for the business fleet, but they have not been able to do so because of a lack of knowledge on their part as to what is wanted and what is needed by the corporate owner.'"

"I am sure," Mr. Dubuque writes, "that Mr. Hewitt didn't mean what he said in the remark, 'The corporate owner . . . doesn't possess sufficient knowledge to ascertain his needs properly.' If he expects to build a service on the assumption that the operator of business aircraft is ignorant of his own requirements, then he has a hard row to hoe. Certainly, no operator would appreciate the view that he lacks intelligence enough to ascertain his needs. Our members have outstanding records of achievement in business aircraft operations and many are vociferous about the improvements that can be made by manufacturers and suppliers."

Mr. Dubuque, in his letter, hopes to "set the record straight and not leave the impression that the interests of the business flyer have been overlooked or neglected."

Another indignant letter came from NBAA's chairman of the board, Cole H. Morrow.

"I am quite amazed," he wrote, "that you would devote so much editorial space to a private promotional undertaking, particularly when, in the past, AVIATION WEEK has notoriously ignored the business flying segment of aviation.

"Like most advertising copy," he writes, "the article is distorted, inaccurate, and certainly not hampered by the facts. I am surprised that Mr. Hewitt would lend his name to the quotes in the article. Apparently neither Mr. Hewitt nor your editorial staff read any other aviation journals because there has been much comment and data published which contradicts statements in the article."

AVIATION WEEK welcomes this opportunity to express its viewpoint on business or utility aviation, as well as to give full opportunity to NBAA, which has displayed such surprising sensitivity on the subject. Mr. Hewitt had expected, instead, to receive pledges of cooperation from NBAA, welcoming him into the field.

We consider business or utility aviation as exceedingly important, or we would not devote so much space to this controversy today.

We are firmly convinced that too little basic information exists about business flying, and our opinion is borne out by important aviation and financial people we have talked to for more than two years. Mail received by Mr. Hewitt since publication of the story would amaze officials of NBAA. It indicates there is an important demand for the right kind of information—not mere handouts or publicity pieces about individual companies that operate planes.

AVIATION WEEK operates on the basis that all intelligent men constantly seek more information to guide their business decisions. No intelligent businessman shuts his eyes to any new source of meaningful information. No association in this important and dynamic field of aviation should feel it has a right to try to maintain a monopoly on information and services and we are sure NBAA did not mean to display such an attitude.

Mr. Dubuque did not read our story carefully or he would know that it at no time cast any aspersions on NBAA. It merely said reputable information available is scarce, which it is. Nor did the story anywhere indicate that NBAA has not been one of the principal authentic sources of information. We just maintain there haven't been enough such sources. Nor did we indicate in any way that NBAA has not tried conscientiously to represent this segment of aviation. We think there is further opportunity not only for those now in the field but for newcomers, too. Nor did we indicate that NBAA had not cooperated with Mr. Hewitt, because they did.

We do disagree with Mr. Dubuque that "virtually all of the services Hewitt indicates they plan to perform are currently being conducted by the Association." The record does not bear this out.

Further, Mr. Dubuque in his letter has substituted the word "intelligence" for "knowledge," in referring to that part of our story which said, "The corporate owner, on the other hand, doesn't possess sufficient knowledge to ascertain his needs properly."

As to Mr. Morrow's comments, we devoted extra space to the Hewitt story because we thought it was news—a new effort to increase the sum total of knowledge about this vital field of aviation. There is no reason for any publication to penalize a "private promotional undertaking" (this is still a land of competition and private enterprise, we feel), nor is there any reason to favor any trade association, even though it feels it has a vested monopoly in its field.

Obviously, the story was not "advertising copy," any more than stories about NBAA would be such, or future stories about firms that may become Mr. Hewitt's competitors. And Mr. Morrow has done himself and NBAA no service in stating that most advertising copy is "distorted, inaccurate and certainly not hampered by the facts."

NBAA meets in St. Louis for its convention this week. We wish them well, but since they have brought the subject up we hope they dust off their glasses, improve their vision, and start on a real service program that gets well above the mere publicity and promotional levels.

—Robert H. Wood

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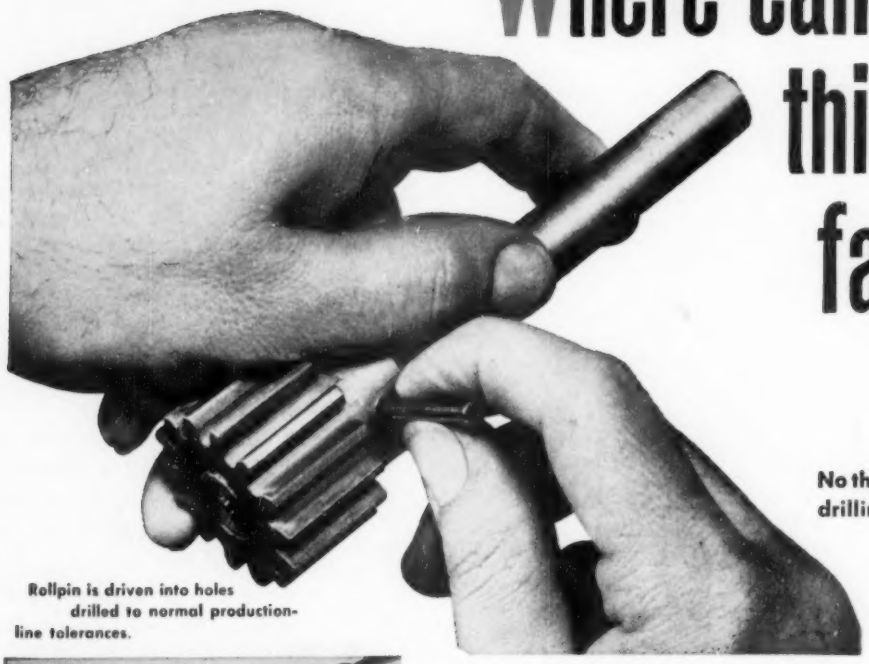

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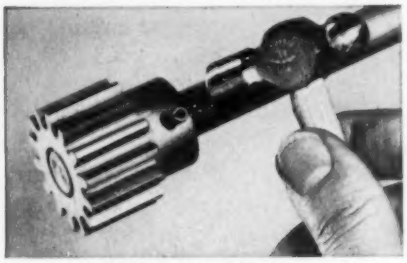

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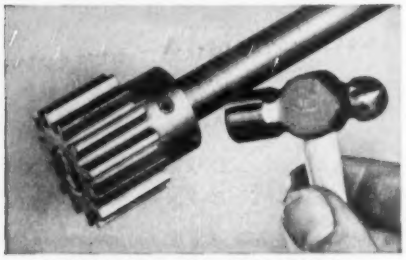

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